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*Proceedings of the  
United States National Museum*

United States National Museum, Smithsonian Institution,  
United States Dept. of the Interior



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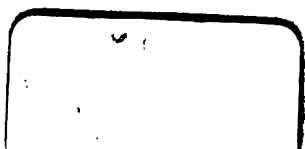
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# PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM

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VOLUME XXX

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WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1906



## ADVERTISEMENT.

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The publications of the National Museum consist of two series, Proceedings and Bulletins.

The Proceedings, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original papers based on the collections of the National Museum, setting forth newly acquired facts in biology, anthropology, and geology derived therefrom, or containing descriptions of new forms and revisions of limited groups. A volume is issued annually or oftener for distribution to libraries and scientific establishments, and in view of the importance of the more prompt dissemination of new facts, a limited edition of each paper is printed in pamphlet form in advance. The dates at which these separate papers are published are recorded in the table of contents of the volume.

The present volume is the thirtieth of this series.

The Bulletin, publication of which was begun in 1875, is a series of more elaborate papers, issued separately, and, like the Proceedings, based chiefly on the collections of the National Museum.

A quarto form of the Bulletin, known as the "Special Bulletin," has been adopted in a few instances in which a larger page was deemed indispensable.

Since 1902 the volumes of the series known as "Contributions from the National Herbarium," and containing papers relating to the botanical collections of the Museum, have been published as Bulletins.

RICHARD RATHBUN,  
*Acting Secretary of the Smithsonian Institution.*



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| New species: <i>Arsenura biundulata</i> , <i>A. drucei</i> , <i>A. thomsoni</i> , <i>A. samba</i> , <i>Automeris meridana</i> , <i>A. vomona</i> , <i>A. annulata</i> , <i>A. innoria</i> , <i>A. pomifera</i> , <i>A. jucundoides</i> , <i>A. hamata</i> , <i>A. moresca</i> , <i>A. parilis</i> , <i>A. orodina</i> , <i>A. curvilinea</i> , <i>Phricodia baroma</i> , <i>Copaxa rufinans</i> , <i>C. marona</i> , <i>C. lineata</i> , <i>Hylesia terranea</i> , <i>Cariria vestalis</i> , <i>Eloria cubana</i> , <i>E. aroensis</i> , <i>E. serena</i> , <i>Doa cubana</i> , <i>Mantruda erratica</i> , <i>Phecada joanna</i> , <i>Cartbara roseilinea</i> , <i>C. umbrata</i> , <i>Lauron albiplaga</i> , <i>Eriopyga griseirena</i> , <i>Xylinissa lignitis</i> , <i>Eudipna templada</i> , <i>Nænia randa</i> , <i>N. sabrella</i> , <i>Ingura sabulosa</i> , <i>Makapta carnescens</i> , <i>Kohlera nelmula</i> , <i>K. bruma</i> , <i>Perigea charada</i> , <i>P. cenola</i> , <i>P. secorra</i> , <i>Nonagria inferna</i> , <i>Hadena jonea</i> , <i>Carbona obscura</i> , <i>Oligia fuscoma</i> , <i>Semiophora bastula</i> , <i>S. punctula</i> , <i>Eustrotia geoga</i> , <i>Iscladia nigra</i> , <i>I. duckinfieldia</i> , <i>I. stroca</i> , <i>Tæniocampa naolina</i> , <i>Cophanta chrysarginea</i> , <i>Plusia caudata</i> , <i>Acanthodia pamela</i> , <i>Trileuca ochracea</i> , <i>Phibromia narecta</i> , <i>Rhaesena jalapena</i> , <i>R. nezeila</i> , <i>R. rubromarginata</i> , <i>Phiprosopus hypenoides</i> , <i>Casandria chirica</i> , <i>Schazama angustipennis</i> , <i>Corubia testacea</i> , <i>Doryodes elongata</i> , <i>Caroga costalis</i> , <i>Pharochlæna cuprea</i> , <i>Palindia argenti-linea</i> , <i>Gonodonta marmorata</i> , <i>Homopyralis picta</i> , <i>H. pandana</i> , <i>Matigramma pamela</i> , <i>Amphigonina brunnea</i> , <i>Peteroma lignea</i> , <i>Cupnodes virginia</i> , <i>Triommatodes angulata</i> , <i>Bendis mascara</i> , <i>B. thara</i> , <i>Chamina choria</i> , <i>Orthogramma ferogia</i> , <i>O. hermesia</i> , <i>Coenipeta glaucoides</i> , <i>C. laurena</i> , <i>C. medalba</i> , <i>C. umbrata</i> , <i>C. musa</i> , <i>C. subocellata</i> , <i>C. subvaria</i> , <i>C. albidentina</i> , <i>Tyriasa carola</i> , <i>Sorygaza acutalis</i> , <i>Neohermia chisena</i> , <i>Bleptina candalis</i> , <i>B. clara</i> , <i>B. margotialis</i> , <i>Tortricodes paulensis</i> , <i>T. dulcena</i> , <i>Megachyta nolualis</i> , <i>M. sabularea</i> , <i>Rhosologia pallida</i> , <i>Adrocampa atomosa</i> , <i>Aristaria orizabalis</i> , <i>A. picatalis</i> , <i>A. trinitalis</i> , <i>A. conspicua</i> , <i>A. bocantis</i> , <i>A. ricalis</i> , <i>A. aztecalis</i> , <i>A. stolalis</i> , <i>Renia ordenalis</i> , <i>R. calalis</i> , <i>R. bipunctalis</i> , <i>Palthis gnoma</i> , <i>P. berthalis</i> , <i>P. calcalis</i> , <i>Mastigophorus pandes</i> , <i>M. lineata</i> , <i>Batyma onesalis</i> , <i>B. francalis</i> , <i>Ilsea bormia</i> , <i>Coscaga angulata</i> , <i>Oralaria guarana</i> , <i>Nictas paulosa</i> , <i>Hyponeumu leucanioides</i> , <i>Hypena oronalis</i> , <i>Argyraetis cineralis</i> , <i>A. guadarensis</i> , <i>A. herminalis</i> , <i>A. jalapalis</i> , <i>A. cytoialis</i> , <i>A. sinualis</i> , <i>Cataclysta jaliscalis</i> , <i>C. orizabalis</i> , <i>C. scaralis</i> , <i>Oligostigma ducalis</i> , <i>Cymoriza parvalis</i> , <i>C. jonesalis</i> , <i>Paraponyx dianalis</i> , <i>P. paulalis</i> , <i>Aulacodes moralis</i> , <i>A. templalis</i> , <i>A. confusalis</i> , <i>A. pampalis</i> , <i>Nymphula franciscalis</i> , <i>Parthenodes berthalis</i> , <i>Macalla paranensis</i> , <i>M. albescens</i> , <i>Jocara apicalis</i> , <i>Deuterollyta pagiroa</i> , <i>Pyrallis garalis</i> . |                              |
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| TRUE, FREDERICK W. Description of a New Genus and Species of Fossil Seal from the Miocene of Maryland.—No. 1475. June 16, 1906 <sup>a</sup> .....   | 835-840 |
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| VAUGHAN, T. WAYLAND. A New Species of <i>Cænocyathus</i> from California and the Brazilian <i>Astrangid</i> Corals.—No. 1477. June 27, 1906 <sup>a</sup> .....  | 847-850 |
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| WALCOTT, CHARLES D. Cambrian Faunas of China.—No. 1458. May 23, 1906 <sup>a</sup> .....   | 563-595 |
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| New species: <i>Coscinoocyathus elvira</i> , <i>Discinopsis sulcatus</i> , <i>Yorkia orientalis</i> , <i>Orthis</i> ( <i>Plectorthis</i> ) <i>agreste</i> , <i>O. (P.) kichouensis</i> , <i>Scenella dilatatus</i> , <i>Platyceras willisi</i> , <i>Stenotheca simplex</i> , <i>Agraulos armatus</i> , <i>A. nitida</i> , <i>A. obscura</i> , <i>A. regularis</i> , <i>A. uta</i> , <i>A. vicina</i> , <i>A. capax</i> , <i>A. melic</i> , <i>Anomocare bigsbyi</i> , <i>A. erioptia</i> , <i>A. flava</i> , <i>Anomocarella contigua</i> , <i>A. irma</i> , <i>Ptychaspis bella</i> , <i>Ptychoparia comus</i> , <i>P. inflata</i> , <i>P. lilia</i> , <i>P. nereis</i> , <i>P. undata</i> , <i>P. vesta</i> , <i>P. maia</i> , <i>P. (Liostracus) intermedia</i> , <i>P. (L.) subrugosa</i> , <i>Solenopleura pauperata</i> , <i>Dolichometopus hyrie</i> . |         |
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| New variety: <i>Doropyge richthofeni larvis</i> .   |         |

<sup>a</sup> Date of publication.

WARREN, WILLIAM. Descriptions of New Genera and Species of South American Geometrid Moths.—No. 1456.<sup>a</sup>

May 11, 1906

399-557

New genera: *Celurotricha*, *Neodeta*, *Notoptya*, *Obelopteryx*, *Cacolyces*, *Xenomigia*, *Aphanophleps*, *Hemipterodes*, *Lobocleta*, *Lobura*, *Omopera*, *Pammeris*, *Schistocolpia*, *Bombia*, *Cophopoda*, *Hemiphricta*, *Neozuga*, *Scoriopsis*, *Idialcis*, *Lepidospora*, *Neazata*, *Atopodes*, *Arentiopsis*, *Neodontopera*, *Symerenis*.

New species: *Antiplecta casia*, *A. cinerascens*, *A. nigripleta*, *A. triangularis*, *Capnophylla albiceps*, *Celurotricha curvilinea*, *Epiplema excoria*, *Gathymia cassata*, *G. ochripennis*, *Neodeta fasciata*, *N. nana*, *N. ochripaga*, *Notoptya fuscularia*, *Siculolopsis dubia*, *S. gracilinea*, *Dolichoneura nigrinotata*, *Obelopteryx angusta*, *Pycnonura rectilineata*, *Athyia cruciata*, *Cyllopoda bipuncta*, *C. radiata*, *Dialeptis celata*, *Ephialtias morena*, *Euchontha castrona*, *Polypetes aniplata*, *Scea obliquaria*, *Scotura discolor*, *S. nigrata*, *Stenoplastis transversa*, *Xenomigia reninotata*, *Anophylla obeliscata*, *Comibana flavicoma*, *Drucia excrescens*, *D. quinquemaculata*, *D. semispurcata*, *Gelasma subrufescens*, *Melochlora affinis*, *M. genustera*, *M. hydatodes*, *M. obnubilata*, *M. vagilinea*, *Miantonota rectilinea*, *Oospila sellifera*, *Racheolopha carnulunata*, *R. cerulea*, *R. confluaris*, *R. continuata*, *R. derasa*, *R. rubescens*, *R. extensata*, *R. florepicta*, *R. lilacina*, *R. lingipalpis*, *R. nivetacta*, *R. pullida*, *R. sporadula*, *Tachyphyle costiscripta*, *T. sulfulata*, *Anisodes abruptaria*, *A. delineata*, *A. flavicornis*, *A. flavipuncta*, *A. leucaniata*, *A. potreria*, *A. striticata*, *A. subriolescens*, *A. terrens*, *Asclodes hebetior*, *Aphanophleps vinosaria*, *A. vulpina*, *Cremodes concomitans*, *C. curta*, *C. fuscifrons*, *Cryptilya borriguria*, *C. ignifera*, *C. subrosea*, *C. subrubella*, *Deinopygia confiser*, *D. falcipennis*, *D. horrifera*, *D. percurrans*, *D. triangulata*, *Dichromatopodia cervina*, *D. purpurea*, *D. rufimedia*, *Dyscephyra albidiscata*, *Enmiltis blandula*, *E. omissa*, *E. tricineta*, *Eumacrodes ereilinea*, *Hamalea comminuta*, *H. fragmentaria*, *H. venipunctata*, *Hemipterodes subnigrata*, *Heterophyra aurata*, *H. fulvescens*, *H. grisea*, *H. scripturata*, *H. semibrunnea*, *Lipomelia tristigata*, *Lobocleta translineata*, *Lobura ocellata*, *Mnesithetis decolor*, *M. rufipuncta*, *Omopera angulata*, *Pammeris albiguttata*, *P. fumata*, *Ptychopoda finita*, *P. fissilinea*, *P. flavicincta*, *P. flexivitta*, *P. imbellis*, *P. marascia*, *P. muscifasciata*, *P. purpureovittata*, *P. rufarenaria*, *P. similinea*, *P. tenebrica*, *P. ustimargo*, *P. vagula*, *P. vitticostata*, *Schistocolpia crinita*, *Sterrhia farada*, *Synelys irrufula*, *Tricentra aurilimbata*, *T. biguttata*, *T. brunneomarginata*, *T. colligata*, *T. consequens*, *T. flavistigma*, *T. ignefumosa*, *T. pererocea*, *T. vinosata*, *Eudule basipuncta*, *E. parca*, *Leptidule sulcifera*, *Cambogia cancellata*, *Bombia protuberans*, *Eratcina brunnea*, *E. satellites*, *Oreonoma rubriplaga*, *Trochiodes subpohliata*, *Cophopoda pyralidimima*, *Docephora fumosa*, *D. nudata*, *D. obscurata*, *Sebastia assimilis*, *S. balteata*, *S. deldaria*, *S. dormita*, *S. humerata*, *S. olivaria*, *S. pallidistriga*, *Tephroclystia anita*, *T. antaria*, *T. collineata*, *T. conduplicata*, *T. consors*, *T. defimbriata*, *T. discipuncta*, *T. gaumaria*, *T. gosselinii*, *T. hastaria*, *T. helenaria*, *T. indecisa*, *T. infrequens*, *T. kurtia*, *T. leucographata*, *T. mediobrunnea*, *T. mollita*, *T. muscistrigata*, *T. parcirufa*, *T. perolivata*, *T. pictimargo*, *T. planipennis*, *T. rauca*, *T. sellia*, *T.*

<sup>a</sup> Date of publication.

*semilignata*, *T. semirufescens*, *T. subalba*, *T. submiranda*, *T. sylpharia*,  
*T. uvaria*, *T. violetta*, *T. westonaria*, *Lomographa discolorata*, *L.*  
*proximata*, *L. ultimata*, *Berberodes cassiteris*, *B. delicata*, *B. simplex*,  
*B. violacea*, *Cirrhosoma curvata*, *Gyostega rufimacula*, *Hemiphricia*  
*albicostata*, *Neozuga latifascia*, *N. strictifascia*, *Phrygonis fratercula*,  
*P. sororcula*, *Astyochia signata*, *Leuculopsis intermedia*, *Myrmeco-*  
*phantes velata*, *Nipteria deformis*, *N. marginata*, *N. sabulosa*, *Scoriopsis*  
*nigrivenata*, *Sangalopsis mediata*, *Bronchelia benepicta*, *B. marcida*,  
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*ilinia*, *C. viriditincta*, *Hymenomima exangulata*, *H. subnigrata*,  
*Idialcis mexicuba*, *Iridopsis eupepla*, *I. fusilinea*, *I. humilis*, *I. inve-*  
*nusta*, *I. memor*, *I. rufisparsa*, *I. transvisata*, *Pherotesia indistincta*,  
*Physocleora albibrunnea*, *P. cretaria*, *P. fulgurata*, *P. fuscicosta*, *P.*  
*nubilata*, *P. rectivecta*, *P. scutigera*, *P. suffusca*, *P. venirufata*,  
*Stenalcidia nitens*, *Stenotrachelys insularis*, *Eupileta subcaesia*, *Hypo-*  
*metalla purpurea*, *H. scintillans*, *Lepidospora lanuginosa*, *Mimo-*  
*phyle parallela*, *Narragodes laevis*, *Porona balteata*, *Neazata multi-*  
*strigaria*, *Sciagraphia stabilata*, *Semiothisa abrupta*, *S. atomaria*, *S.*  
*decorata*, *S. fervens*, *S. lapidata*, *S. liquata*, *S. multistriata*, *S. pluri-*  
*maculata*, *S. punctistriata*, *S. subfulva*, *S. sarda*, *Tephрина albisecta*,  
*T. confertistriga*, *Tephrinopsis indeterminata*, *Xenocista trimaculata*,  
*Acrotomodes unicolor*, *Asestra lineata*, *Atopodes singularis*, *Arentiops-*  
*is ochrea*, *Caberodes aspilataria*, *C. nexilinea*, *Cannagara himerodes*,  
*Crocoteryx hilaris*, *C. venusta*, *Cyclomia lilacina*, *C. strigifera*, *C.*  
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*Entomopepla bipars*, *Gonorthus bilineata*, *Ira albirenata*, *Microgonia*  
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*M. resperitilio*, *M. xanthopepla*, *Minogonodes subsignata*, *Mimosema*  
*dorsilinea*, *Mychonia excisa*, *Nematocampa falsa*, *Neodontopera*  
*cinurea*, *Numia albisecta*, *Patalene sordida*, *Periclina cervina*, *Pero-*  
*binasata*, *P. disjuncta*, *P. fœda*, *Polla albipuncta*, *Pyrinia æmula*,  
*P. albilineata*, *P. insula*, *P. praeifulva*, *Syncrenis ustimargo*.  
New varieties: *Anisodes aurantiata* variety *atridiscata*, *Dysephyra*  
*albidiscata* variety *nigridiscata*, *Bassania amethystata* variety  
*extremata*.

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# A STUDY OF THE JAMES TYPES OF ORDOVICIAN AND SILURIAN BRYOZOA.

By RAY S. BASSLER,

*Assistant Curator, Department of Geology.*

Mr. U. P. James was one of the pioneer students of the splendid fauna of the Cincinnati group, and at various times between 1871 and 1883 printed the results of his studies in private and other publications. In these papers Mr. James described a considerable number of bryozoa as well as of other classes of fossils, but almost invariably failed to illustrate his species. Some of his names were recognized by subsequent writers who redescribed and illustrated his species, but the majority are still as left by their author.

Some years ago the James collection became a part of the paleontologic collection of Walker Museum of the University of Chicago, and its types are now accessible for study. The present paper is devoted to a consideration of the bryozoa described by Mr. James, and is based not only upon the James types but also upon numerous authentic specimens received from Mr. James and now in the collection of the U. S. National Museum. However, most of these bryozoa (Trepotomata) he referred to the Tabulate corals, others (Cryptostomata) to the bryozoa, while a few were placed with *Stromatopora* and the sponges. It is hoped that the conclusions reached by the present writer in regard to the validity and synonymy of the various species are fair to both Mr. James and subsequent workers along the same line.

The writer is under obligations to Professors Chamberlin and Weller for the opportunity of studying this portion of the James collection, and especial thanks are due Professor Weller for his help and advice at various times.

## INTRODUCTION.

The early systematic work in all branches of natural history is obviously more or less faulty when compared with the standard obtaining to-day, just as many imperfections will no doubt be found by the future student in the results of present researches. This is especially true in regard to paleontologic work, where the student's observations

are limited to more or less imperfect remains, and when, in addition, a class such as the Bryozoa requires the microscopic as well as the macroscopic characters for the delimitation of species, it is not astonishing that pioneer work in such a field should be quite imperfect.

All of the Paleozoic systems of the North American continent, with the exception of the Cambrian, afford a large number of Bryozoa which have essentially the same general macroscopic features, but which show their specific differences mainly upon microscopic examination. This applies particularly to species of the order Trepostomata, or, as they have been commonly designated, the *Monticuliporoids*. Species of Trepostomata as well as of the other orders were described from the external characters alone until 1876, when Doctor Nicholson published his paper Notes on the Paleozoic Corals of the State of Ohio.<sup>a</sup> Here for the first time the internal characters were studied and illustrated by means of thin sections. This and succeeding articles by the same writer pointed out the way for the accurate study of the monticuliporoids. Previous to the date mentioned, names such as *Chaetetes lycoperdon* or *C. petropolitanus* were applied to almost any massive paleozoic bryozoan, while *Stenopora fibrosa* was a convenient designation for ramose forms irrespective of their geological horizon. To-day the characterization of any new species, particularly of the Trepostomata, is incomplete without the description and illustration of the internal structure as well as the external features. Fortunately some of the species hitherto described without a study of their internal parts have such well-marked external characters that, with good illustrations of the latter, it has been possible to identify the species. The generic characters being in nearly all cases internal, it remained for subsequent authors to properly place such species.

Several authors have described a considerable number of bryozoa almost entirely without illustration. In a few cases the specific characters are so salient that little trouble is experienced in identifying the species, but in the majority of cases it is impossible to do so without an examination of the original types. To determine the status of as many as possible of these more or less obscure species, and thus to clear up the literature of the subject, has been the endeavor of the writer for some years. In the identification and final recognition of such species, especially when the synonymy, if any, is in question, one's personal equation is so liable to enter that considerable care is necessary in order to obtain unbiased results. The writer has tried to eliminate this element in work of this character by adhering strictly to the rules of nomenclature. The Code of Nomenclature adopted by the American Ornithologists Union (New York, 1892) contains probably the best and most recent expression of the laws upon this subject, and the rules employed in this paper and cited later are quoted from this valuable work.

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<sup>a</sup>Ann. Mag. Nat. Hist. (4), XVIII, 1876, pp. 85-94, pl. v.

In the application of these rules to the James types, many difficulties are encountered. These occur especially in those cases where the specimens marked as types fail to conform in important respects with the original descriptions. In many cases it seems almost certain that the specimens now marked as the types were not the ones originally used by the elder James in describing the species. Furthermore, it is probable that the selection of the types occurred subsequently, possibly when the younger James joined his father in the study of these organisms. As it is now impossible to determine this point, and as labels in the elder James's handwriting in every case accompany the type, we must accept the specimens thus marked as the original types and apply the rules to these.

The study of these type specimens has forcibly impressed upon the writer the caution that ought to be observed by cataloguers in recording literature of this kind. In 1900<sup>a</sup> Nickles and the writer recognized a number of the poorly defined James species, placing well defined and figured species of other authors as synonyms. These identifications were based mainly upon "authentic" specimens one of them had received from Mr. U. P. James, and also partly upon their interpretation of his descriptions. Unfortunately this interpretation and the authentic specimens do not in a number of cases agree with the types, thus making a revision of the synonymy necessary.

#### BIBLIOGRAPHY.

The paleontological publications of Mr. U. P. James commenced in 1871 with the issue of a Catalogue of Lower Silurian Fossils. In this pamphlet a few species now referred to the bryozoa were named but not described. In a second and enlarged edition of the catalogue, which appeared in 1875, these and other species were briefly described. In July, 1878, appeared the first number of the *Paleontologist*, a private publication devoted to geology and paleontology. Seven numbers, consisting altogether of 53 pages and 2 plates, were issued at irregular intervals from 1878 to 1883. The descriptions in this paper are often clear and concise, and have the additional advantage of including accurate measurements, as well as a statement of the horizon, locality, and range of the species. In the treatment of the monticuliporoids, in Nos. 6 and 7, more or less detailed accounts of their internal structure are given. Five additional species of this class are described by Mr. James in articles appearing in the *Journal of the Cincinnati Society of Natural History*. Many of the descriptions in the foregoing articles are, as mentioned before, clear and concise and show that their author was not only an acute observer, but also appreciated the value of both external and internal characters in the discrimination of species belonging to this group.

The series of papers by U. P. James and Joseph F. James, listed

<sup>a</sup>Bull. U. S. Geol. Surv., No. 173, 1900.

below and entitled *On the Monticuliporoid Corals of the Cincinnati Group, with a Critical Revision of the Species*, contains a treatment of the monticuliporoids that is in marked contrast to the previous work of the elder James. The form and surface characters of the zoarium are now considered the diagnostic points, and the species and synonymy are arranged accordingly. Joseph F. James continues the same style of work in his *Manual of the Paleontology of the Cincinnati Group*, but his death left this series of articles unfinished.

The following list and remarks upon the papers of both U. P. and J. F. James relate only to those which deal in part or wholly with bryozoa or organisms which have proved to be bryozoa.

U. P. JAMES.

1. CATALOGUE OF LOWER SILURIAN FOSSILS, CININNATI GROUP, CININNATI, 1871.

Under the heading of Zoophyta lists the Bryozoa of the Cincinnati group.

2. ADDITIONS TO CATALOGUE OF LOWER SILURIAN FOSSILS, CININNATI GROUP, CININNATI, 1873.

Lists several additional species of Bryozoa and corrects some of the earlier names.

3. CATALOGUE OF LOWER SILURIAN FOSSILS OF THE CININNATI GROUP, WITH DESCRIPTIONS OF SOME NEW SPECIES OF CORALS AND POLYZOA, CININNATI, 1875.

This is an enlarged edition of the catalogue of 1871 and contains in addition an introduction wherein the following new species of Bryozoa are described: *Chaetetes* ? *calycula*, *C. clavacoides*, *C. cincinnatiensis*, *C. ? onealli*, *Ceramopora nicholsoni*, *Ptilodictya acuminata*, and *Alecto nexilis*.

4. THE PALEONTOLOGIST, No. 1, pp. 1-8, CININNATI, JULY 2, 1878.

Contains descriptions of the following species of Bryozoa: *Chaetetes crustulatus*, *C. sp. ? (meeki suggested)*, *C. sp. ? (varians proposed)*, *Fistulipora* ? *multi-pora*, *Helopora dendrina*, *H. tenuis*, *H. meeki*, *H. parrula*, *H. approximata*, *Ptilodictya hilli*, *P. plumaria*, *P. flexuosa*, *P. granulosa*, *P. paralella*, *Ceramopora* ? *beani*, *C. ? irregularis*, *C. alternata*, *C. concentrica*, *Hippothoa delicatula*, *Ptilodictya fimbriata* and *P. sp. ? (welshi proposed)*.

5. THE PALEONTOLOGIST, No. 2, pp. 9-16, CININNATI, SEPT. 14, 1878.

The following species of Bryozoa are described: *Chaetetes lycoperdon*, *C. petropolitae*, *C. turbinatum*, *Callopora milfordensis*, *Ceramopora whitei*, and *C. radians*.

6. THE PALEONTOLOGIST, No. 3, pp. 17-24, CININNATI, JAN. 15, 1879.

Describes the following species which are now regarded as Bryozoa: *Stromatopora* ? *lichenoides*, *Fistulipora siluriana*, *Chaetetes minutus*, *C. crustulatus*, *C. lycopodites*, *Ptilodictya nodosa*, *P. platyphylla*, *Escharina distorta*, and *Sagenella striata*.

7. THE PALEONTOLOGIST, No. 4, pp. 25-32, CININNATI, JULY 10, 1878.

No Bryozoa are described in this number, which includes a "Supplement to Catalogue of Lower Silurian Fossils of the Cincinnati Group." Under the headings of Polypi and Polyzoa, this supplement lists the species of Bryozoa and in some cases indicates the synonymy.

8. THE PALEONTOLOGIST, No. 5, pp. 33-44, CININNATI, JUNE 10, 1881.

In this number the following Bryozoa are described: *Monticulipora* (*Chaetetes*) *whitfieldi*, *M. (C.) meeki*, *M. (C.) varians*, *Dekayia maculata*, *Ptilodictya antiqua*, *P. cleavelandi*, *P. kentuckyensis*, *P. clintonensis*, *P. ? cincinnatiensis*, *P. grahami*, *P. dubia*, and *P. teres*.

## 9. THE PALEONTOLOGIST, No. 6, PP. 45-56, CINCINNATI, SEPT. 12, 1882.

This number is devoted entirely to species of *Monticulipora* and contains descriptions of both the external and internal features of the following: *Monticulipora* (*Heterotrypa*) *clintonensis*, *M.* (*H.*) *circularis*, *M.* (*H.*) *onealli*? var. *communis*, *M.* (*H.*?) *eccentrica*, *M.* (*H.*) *winchelli*, *M.* (*H.*?) *cleavelandi*, *M.* (*Monotrypa*) *wortheni*, *M.* (*M.*) *welchi*, *M.* (*M.*?) *subfusiformis*, and *M.* (*M.*) *dychei*.

## 10. THE PALEONTOLOGIST, No. 7, PP. 57-59, PLS. I, II, CINCINNATI, APRIL 16, 1883.

Describes *Monticulipora kentuckensis* and *Helopora harrisi*.

The plates contain rough sketches of the Bryozoa described in this and the preceding number of the Paleontologist. These figures are of little or no value in the identification of the species.

All of the above references are to pamphlets published privately by Mr. James. Some writers, notably Mr. S. A. Miller in his North American Geology and Paleontology, have ignored these pamphlets altogether, mainly because of their obscure mode of publication, but also because many of the species are "not defined so as to be recognized." Other writers have adopted some of Mr. James's specific names and rejected others, but inasmuch as all of these papers fill the requirements of publication, there is no reason for ignoring the work as a whole, no matter how difficult it may be to recognize the species described. The A. O. U. Code of Nomenclature states that "Publication consists in the public sale or distribution of printed matter, books, pamphlets, or plates" (Canon XLVII), but recommends that authors avoid publishing in obscure pamphlets of limited circulation. The Paleontologist, although certainly of the class to be avoided, must be recognized under the rules since copies were distributed to some extent by the author, and were also placed on sale at his book store in Cincinnati, where they may still be obtained.

The following references are to articles appearing in the proceedings of a well established scientific society, and hence there is no question in regard to their recognition as publications:

## 11. DESCRIPTIONS OF THREE SPECIES OF FOSSILS. JOURNAL CINCINNATI SOCIETY NATURAL HISTORY, VII, 1884, PP. 21-24.

Describes and gives fairly good illustrations of two bryozoa, *Fistulipora oweni* and *Ceramopora*? *beani*.

## 12. DESCRIPTIONS OF FOUR NEW SPECIES OF FOSSILS FROM THE CINCINNATI GROUP. JOURNAL CINCINNATI SOCIETY NATURAL HISTORY, VII, 1884, PP. 137-139, PL. VII.

Describes and illustrates two new bryozoa, *Monticulipora ohioensis* and *M. falcis*. The article also includes descriptions and figures of more or less weathered examples of *Ceramoporella*, which are referred to *Stromatopora* under the name of *S. tubularis* and *S. Ludlowensis*.

## U. P. JAMES AND J. F. JAMES.

## 13. ON THE MONTICULIPOROID CORALS OF THE CINCINNATI GROUP, WITH A CRITICAL REVISION OF THE SPECIES. JOURNAL CINCINNATI SOCIETY OF NATURAL HISTORY, X AND XI.

PART 1, VOLUME X, 1887, PP. 118-141.

PART 2, VOLUME X, 1888, PP. 158-184, PL. I.

PART 3, VOLUME XI, 1888, PP. 15-47, PL. I.

The three installments by U. P. and J. F. James noted above were bound together and distributed by their authors under the title of

Monograph of the Monticuliporoid Corals of the Cincinnati Group. In this monograph external characters alone are employed in distinguishing species, and as a result the specific synonymy given is a revelation. The various monticuliporoid genera and subgenera proposed, particularly those by Nicholson and Ulrich, are made synonyms of either Hall's *Ceramopora* or D'Orbigny's *Monticulipora*. Only *Dekayia* Edwards and Haime, *Constellaria* Dana, and *Fistulipora* McCoy are recognized, and these only as subgenera of *Monticulipora*. The correct placing of some of the synonymous genera seems to have troubled the authors. For example, *Crepipora* and *Chiloporella* are first placed as synonyms of *Ceramopora* and *Monticulipora*, respectively, but in the last installment the authors decide that the subgenus *Fistulipora* is the proper name with which to make them synonymous. However, even this is not final, as later in the same paper *Crepipora* is again made a synonym of *Ceramopora*.

The synonymy of species is on a par with the generic work, as may be illustrated by one of many examples. *Callopora cincinnatiensis* and *Chiloporella flabellata* of Ulrich are considered synonyms of *Monticulipora nicholsoni* James, the two synonyms being founded, according to James and James, "upon slightly worn specimens." It happens, however, that *Callopora cincinnatiensis* is founded upon well-preserved specimens of *Lioclema occidens* (Hall and Whitfield) from the Upper Devonian of Iowa, and, as admitted by Ulrich,<sup>a</sup> was erroneously recorded as coming from Cincinnati.

No new species are described in these articles, but many of the James species are figured on the two plates. These figures, especially the illustrations of the surface characters of the various species, are misleading and in many cases are quite unlike the specimens they are said to represent. For example, contiguous angular, polygonal zoecia, such as are exhibited by the specimens called *Monticulipora turbinata*, are represented as more or less irregularly rounded and separated by a space of varying diameter, with here and there a rounded mesopore interpolated.

This series of articles appearing several years after Nicholson's excellent volume *The Genus Monticulipora*, can not be excused on the ground of pioneer work. Instead of marking an advance upon work in the *Paleontologist*, the monograph is very much inferior to the earlier publication, and instead of being the promised aid to the student, the articles are positively confusing and detrimental to progress.

JOSEPH F. JAMES.

14. *MANUAL OF THE PALEONTOLOGY OF THE CINCINNATI GROUP.* JOURNAL CINCINNATI SOCIETY OF NATURAL HISTORY, XV-XVIII.

VOLUME XV, 1893, pp. 144-159.

VOLUME XVI, 1894, pp. 178-208.

VOLUME XVIII, 1895, pp. 67-88.

VOLUME XVIII, 1896, pp. 115-140.

This series of articles differs from the preceding in its less critical tone and iconoclastic spirit. The synonymy is considerably modified, more species now being recognized as valid. The same specific grouping according to zoarial growth is followed, but the author has apparently modified his views as to the value of internal characters, since these are now noted in his descriptions. The work was left unfinished by the death of the author.

#### LAWS OF NOMENCLATURE.

In order to avoid repetition in the descriptive portion of this work, the writer has selected and quoted below such laws of nomenclature as will be found to have special application to the James species. These are given as published in the Code of Nomenclature adopted by the American Ornithologists' Union (New York, 1892), and it is believed that the canons quoted cover all the cases afforded by the James bryozoan species.

##### OF THE RETENTION OF NAMES.

*Canon XXXII.*—A *nomen nudum*, generic or specific, may be adopted by a subsequent author, but the name takes both its date and authority from the time when, and from the author by whom, the name becomes clothed with significance by being properly defined and published.

##### OF THE REJECTION OF NAMES.

*Canon XXXIV.*—A *nomen nudum* is to be rejected as having no status in nomenclature.

*Canon XXXVI.*—A name resting solely on an inadequate diagnosis is to be rejected, on the ground that it is indeterminable and therefore not properly defined.

*Canon XXXIX.*—A name which has never been clearly defined in some published work is to be changed for the earliest name by which the object shall have been so defined, if such name exist; otherwise a new name is to be provided, or the old name may be properly defined and retained, its priority and authority to date from the time and author so defining it.

##### OF THE DEFINITION OF NAMES.

*Canon XLIII.*—The basis of a specific or subspecific name is either (1) an identifiable published description, or (2) a recognizable published figure or plate, or (3) the original type specimen or specimens, absolutely identified as the type or types of the species or subspecies in question; but in no case is a type specimen to be accepted as the basis of a specific or subspecific name, when it radically disagrees with or is contradictory to the characters given in the diagram or description based upon it.

*Canon XLV.*—Absolute identification is requisite in order to displace a modern current name by an older obscure one.

##### OF THE PUBLICATION OF NAMES.

*Canon XLVII.*—Publication consists in the public sale or distribution of printed matter—books, pamphlets, or plates.

# CLASSIFICATION OF ORDOVICIAN STRATA IN THE VICINITY OF CINCINNATI, OHIO.

Various classifications of the Cincinnati rocks have been proposed from time to time, but reference to most of these is unnecessary, especially since the subject was ably discussed and reviewed by Nickles in 1902.<sup>a</sup> At that time this author indicated all of the divisions of the Cincinnati series, but applied names only to the various beds of the Lorraine. In a subsequent paper<sup>b</sup> he named the divisions of the Richmond group. More recently Foerste<sup>c</sup> has proposed several new names as well as a few changes.

The classification presented below is one now in preparation for publication by Mr. E. O. Ulrich of the U. S. Geological Survey and the writer, and will be employed for mapping purposes in the Cincinnati area. As the publication of this article may be delayed, departures from the classifications of Nickles and Foerste, and the new terms are briefly discussed below. The thickness of the various divisions is indicated by giving their range in height above low-water mark in the Ohio River, starting at a point where the lowest beds are exposed, namely, at West Covington, or at Bromley, Kentucky, and supposing that the rocks are horizontal. The heights mentioned are thus only relative and this method is introduced here mainly because it was employed by Mr. James and most of the other Cincinnati paleontologists in locating the horizon of their fossils.

|                    | Formation<br>(mapable units). | Members.             | Approximate height<br>in feet above<br>low-water<br>mark in Ohio<br>River. |
|--------------------|-------------------------------|----------------------|--|
| Cincinnati series. | Richmond group .....          | Saluda .....         | 665-700  |
|                    |                               | Whitewater .....     | 625-665  |
|                    |                               | Liberty .....        | 590-625  |
|                    |                               | Waynesville .....    | 540-590  |
|                    |                               | Arnheim .....        | 460-540  |
|                    | Covington group .....         | McMillan .....       | 425-460  |
|                    |                               | { Corryville .....   | 390-425  |
|                    |                               | { Bellevue .....     | 375-390  |
|                    |                               | { Fairmount .....    | 325-375  |
|                    |                               | { Mt. Hope .....     | 280-325  |
| Trenton            | Eden .....                    | McMicken .....       | 220-280  |
|                    |                               | Southgate .....      | 100-220  |
|                    |                               | Economy .....        | 50-100   |
|                    |                               | Fulton .....         | 45- 50   |
|                    |                               | Point Pleasant ..... | 30- 45   |
|                    | Bromley .....                 |                      | 0- 30  |

<sup>a</sup> The Geology of Cincinnati. Jour. Cincinnati Soc. Nat. Hist., XX, 1902, pp. 49-101.

<sup>b</sup> American Geologist, XXXII, 1903, pp. 202-218.

<sup>c</sup> Science, XXII, 1905, No. 553, pp. 149-152.

*Bromley*.—This name is applied to the series of drab to dark blue shales underlying the Trenton limestone outcropping along the Ohio River bank opposite Cincinnati. These shales are about 30 feet in thickness and are well exposed along the river just below Bromley, Kentucky. The characteristic fossils are trilobite remains and a form of *Dalmanella*, both of which occur in comparative abundance, although other fossils are rare. This division is probably the equivalent of the Hermitage formation of Tennessee.

*Point Pleasant*.—The strata to which this name was applied by Prof. Edward Orton are represented in the vicinity of Cincinnati by the Trenton limestone overlying the Bromley shales. Here, on account of erosion preceding the deposition of the Utica, these limestones are not more than 25 feet thick, but at the type locality a considerable thickness is added to the top. *Eridotrypa briareus* is the most characteristic fossil, and the strata represent probably the whole of the Bigby and Catheys of Tennessee.

*Covington group*.—This term is proposed to embrace all the strata in the Cincinnati area from the top of the Trenton to the base of the Richmond. It thus includes the Utica and Lorraine of previous authors.

*Fulton*.—The typical Utica is represented along the Ohio River by only a few feet (seldom more than 5) of dark gray or drab colored shales which contrast very distinctly with the overlying Eden shales. These strata are well exhibited along the Ohio River bank at Fulton, the old name for the eastern part of Cincinnati. *Triarthrus becki*, *Leptobolus insignis*, graptolites and other typical Utica fossils are abundant.

*Eden*.—The Eden shales of Professor Orton may be divided into three members well marked both faunally and lithologically. Hitherto these have been indicated by the divisions lower, middle, and upper Utica, with the exception that the lower Utica has included both the members here called Economy and Fulton.

*Economy*.—This term, the old name of the village now known as West Covington, Kentucky, is applied to the lower division of the Eden. About 50 feet of blue shales and limestones comprise this member, which is distinguished faunally by a large number of bryozoa, the characteristic species being *Coeloclema commune*, *Crepipora venusta*, and several forms of *Aspidopora*.

*Southgate*.—The middle Eden beds are well exposed just south of Newport and Covington, Kentucky, particularly in the vicinity of Southgate, so that the latter name may be employed to distinguish them. This division consists of about 120 feet of blue to yellow shales, with fewer limestones than in the rest of the Eden. The lower beds of this member contain a considerable number of gastropods and pelecypods, while throughout the entire member, *Otenobolbina ciliata*,

*Aspidopora eccentrica*, and *Batostoma jamesi* are particularly abundant and characteristic.

*McMicken*.—The upper third of the Eden consists of about 60 feet of highly calcareous and extremely fossiliferous shales and limestones holding the bryozoan *Dekayella ulrichi* in great abundance. Good exposures occur along McMicken avenue, Cincinnati, whence the name for the division.

*Fairview*.—Nickles's divisions of Mount Hope and Fairmount, although useful for detailed work, are so closely related faunally and distinguished with such difficulty that for mapping purposes the term Fairview, from Fairview Heights at Cincinnati, is here proposed to embrace both. The Fairview formation is about 100 feet thick, and is the equivalent in part of the "Hill quarry beds" of Professor Orton.

*McMillan*.—The Bellevue, Corryville, and Mt. Auburn members are closely related and not of sufficient importance to be mapped separately. The three are here recognized as members of the new formation, the McMillan, from the street of that name at Cincinnati, along which the 85 feet of strata comprising this formation are fairly well exposed.

*Arnheim*.—Nickles's term Warren being preoccupied, the new name Arnheim was proposed<sup>a</sup> for this division, which here is considered a part of the Richmond group rather than of the Lorraine, as hitherto placed. Excellent exposures of these strata are found in the vicinity of Oregonia and Lebanon, Ohio.

#### DISCUSSION OF SPECIES IN ALPHABETICAL ORDER.

In many cases the James type lots contain such a variety of specimens, or are so involved in other respects, that it has seemed best to discuss in alphabetical order not only Mr. James's own species but also those of which his forms have proved to be synonyms. In order to facilitate reference to any particular form, this discussion of species is followed by an index. The synonymy of some of the species is so extended that for the sake of space, only that part of it essential to this paper is given. The complete synonymy is presented in Bulletin U. S. Geological Survey, No. 173.

#### ALECTO NEXILIS James.

*Alecto nexilis* JAMES, Intr. Catal. Foss. Cincinnati Group, 1875, p. 3.

*Original description*.—"Polyzoary attached to branches of coral, consisting of thread-like tubes anastomosing closely, resembling fine network, with 7 or 8 meshes in the space of a line; the little circular mouths are raised and at irregular distances, varying from one-eighth to one-sixteenth of a line apart.

"The typical specimen of this species is spread over a small,

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<sup>a</sup> Foerste, Science, XXII, 1905, No. 553, p. 151.

uneven, cylindrical branched coral, from one-fourth to three-eighths of an inch in diameter.

"Found at Cincinnati, about 400 feet above low water of the Ohio River."

The above description would lead one to believe that the form under consideration was a very small species of *Stomatopora* incrusting foreign objects. The type specimen, however, is not incrusting, but is a solid ramose bryozoan belonging to the species later named by Ulrich and described by Nicholson as *Monticulipora (Heterotrypa) implicata*, now referred to the genus *Batostoma*. James's description was based upon the surface of this highly acanthopored species, his network or meshes being formed by the zoecial walls and the large perforated acanthopores representing the "little circular mouths." The name *Alecto nerilis*, therefore, has no standing since it rests on an inadequate diagnosis and the species will take the name given by Nicholson, this being the first by which the object was clearly defined. Nicholson accredits the species to Ulrich, but this is incorrect because, although Ulrich did first recognize the species as distinct, his name of *Chaetetes implicatus* published in a catalogue is merely a *nomen nudum*.

*Batostoma implicatum* is quite an abundant fossil in the Eden shale at Cincinnati and vicinity, but in no instance, to the best of the writer's knowledge, has it been found in beds above the top of this formation (about 280 feet above low water in the Ohio River). James's reference of his *Alecto nerilis* to the 400-foot level (Corryville bed) is therefore probably incorrect.

#### AMPLEXOPORA DISCOIDEA (Nicholson).

*Chaetetes discoideus* JAMES, Catal. Foss. Cincinnati group, 1871, p. 4. (Named but not defined.)

*Chaetetes discoideus* NICHOLSON, Quar. Jour. Geol. Soc. London, XXX, 1874, p. 511, pl. xxx, figs. 4-4d.

*Chaetetes discoideus* NICHOLSON, Geol. Surv. Ohio, Pal., II, 1875, p. 206, pl. xxi, figs. 15-15c.

*Monticulipora (Monotrypa) discoidea* NICHOLSON, Genus Monticulipora, 1881, p. 193, pl. iv, figs. 3-3f.

*Monticulipora discoidea* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 163.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 178.

*Amplexopora discoidea* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 255.

Nicholson accredits this species to James, but inasmuch as the latter named it without definition, *Chaetetes discoideus* James is a *nomen nudum*. The James types of *Chaetetes discoideus* include, in addition to the well-known form described by Nicholson under the same name, specimens of *Amplexopora petasiformis* (Nicholson) and *Aspidopora newberryi* (Nicholson) from the Eden shale, *Prasopora hospitalis* (Nicholson) from the Richmond group, and several undetermined species ranging in time from the Eden to the Richmond. These various

species agree in one character only, namely, the discoid method of growth.

*Amplexopora discoidea* is readily recognized by its discoid habit of growth, absence of mesopores and by rather numerous acanthopores and diaphragms.

*Occurrence*.—A characteristic fossil of the Fairmount member of the Covington group at Cincinnati, Ohio, and vicinity.

#### AMPLEXOPORA FILIOSA (D'Orbigny).

Plate III, figs. 1-3.

*Monticulipora filiosa* D'ORBIGNY, Prodr. de Pal., I, 1850, p. 25.

*Leptotrypa filiosa* ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 456, pl. xxxvi, figs. 7, 7a.

*Monticulipora filiosa* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 162.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XV, 1893, p. 158.

*Amplexopora filiosa* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 164.

*Monticulipora subcylindrica* (U. P. JAMES, MS.) J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1896, p. 123, fig. 13a-c.

The type lot of James's *Monticulipora subcylindrica* consists of two specimens, one of which is an example of *Dekayella ulrichi* and the other—the one from which his illustrations were prepared—proves to be the same as *Amplexopora filiosa* (D'Orbigny). Under the circumstances, only the figured specimen should or can be considered as the type of James's species. As this is an unquestionable example of *A. filiosa*, a species described long before by D'Orbigny and well known to Cincinnati collectors, James's *M. subcylindrica* naturally falls into synonymy under *A. filiosa*. The unfigured specimen resembles the figured type only in that it is a thick subcylindrical stem. In all other respects it differs decidedly and shows the characters of *Dekayella ulrichi*. (Plate II, figs. 3, 4.) The figured specimen differs from the ordinary masses of *Amplexopora filiosa* merely in this, that in growing over and completely covering an *Orthoceras* it finally assumed a subcylindrical shape. This is not an unusual occurrence, though the majority of specimens are irregularly massive or hemispheric in shape. J. F. James has illustrated the internal characters of the specimen regarded as the type of his species, but thin sections of the same prepared by the writer show that his figures are not only misleading but also incorrect. On Plate III of this paper the views presented by these thin sections have been carefully drawn.

*Amplexopora filiosa* is a characteristic and not uncommon fossil ranging from the Fairmount to and through the Corryville members throughout the Ohio Basin, and may readily be recognized by its massive zoaria, monticulated surface, thin-walled polygonal zoecia and absence of mesopores. The size of the zoarium in specimens seen by the writer has varied from lumps less than 25 mm. in diameter to

dome-shaped masses 400 mm. wide and 200 to 300 mm. in height. The surface is generally monticulated, the monticules usually being low and rounded but sometimes strongly elevated and sharply pointed. Nine of the ordinary zoecia may be counted in a distance of 2 mm. Acanthopores are present in the successive mature zones, but are seldom readily noticeable at the surface.

The internal characters of this species are unusually well marked and constant. A vertical section shows that the zoarium is made up of successive zones distinguished by variations in tabulation and other respects. Often the zones are separated by clay-filled interspaces, but in most cases the zoecial tubes are practically continuous throughout a zoarium. In such specimens the individual zones can only be distinguished by the alternate development of immature and mature regions. In each of the successive immature regions the zoecia have thin walls and few or no acanthopores. Diaphragms are present but are separated from each other by distances varying from 1 to 2 tube diameters. This region passes upward, sometimes abruptly but more commonly rather gradually, into the mature region in which the walls are considerably thickened, small acanthopores developed in large numbers, and the diaphragms increased in number so that two or even three occur in a distance equal to their own diameter. An occasional curved or funnel-shaped diaphragm, like those frequently seen in the typical species of the genus, also may be observed in the mature region. Tangential sections passing through the mature zone bring out especially the character separating the genus *Amplexopora* from the otherwise quite similar group recently named *Cyphotrypa*. This is, namely, the presence of a central black line separating the walls of adjoining zoecia. In the latter genus the zoecial walls are so amalgamated that their boundaries can not be distinguished, the central portion being clear or light colored. The zoecia in the immature region have such thin walls that sections show no structural features.

*Occurrence.*—Fairmount, Bellevue, and Corryville members of the Covington group at many localities in the Ohio Basin. Cincinnati, Ohio, is the type locality for both D'Orbigny's and James's specimens.

#### AMPLEXOPORA PETASIFORMIS—WELCHI (James).

*Monticulipora (Monotrypa) welchi* JAMES, Paleontologist, No. 6, 1882, p. 50; No. 7, 1883, pl. 1, figs. 4-4c.

*Monticulipora petasiformis* var. *welchi* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 169.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 187.

*Amplexopora petasiformis-welchi* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 165.

This variety differs from *A. petasiformis* only in the shape of the zoarium, which tends to assume a subramose or ramose growth instead of the usual hat-shaped masses. Variety *welchi* is of interest mainly

in that it bridges the gap between the typical ramose species of *Amplexopora* and the massive forms, such as *A. filiosa* or *A. petasiformis*.

*Occurrence*.—Eden shale, Cincinnati, Ohio, and vicinity.

#### ARTHROPORA CINCINNATIENSIS (James).

Plate IV, fig. 7.

*Ptilodictya? cincinnatiensis* JAMES, Paleontologist, No. 5, 1881, p. 39.

This is one of the Cincinnati species of *Arthropora*, a genus of bifoliate bryozoa characterized by its regularly and frequently jointed zoaria. In its zoecial structure the species is very similar to the abundant *A. shafferi* (Meek), but the respective zoarial peculiarities of the two forms are so constant and evident as to justify their recognition as distinct species. James gave a fairly good description of his species, a part of which is quoted below, and his diagnosis, together with the figure of the type presented on Plate IV, will probably serve for its ready identification.

*Original description*.—"Polyzoary \* \* \*, consisting of sub-cylindrical, or cylindrical stems, giving off lateral branches from half a line to one line apart at an angle, generally of about 45 degrees; branches varying in length from half a line to over one line; diameter of stems about half a line. The pores vary from long oval to subcircular in shape, and are arranged in alternating rows, three or four in the space of half a line measuring their longer diameter (longitudinally), and nearly twice that number transversely; separated, generally, about their own diameter apart. \* \* \* "

Compared with *Arthropora cleavelandi* (James) with which *A. cincinnatiensis* agrees most nearly in growth, the latter may be distinguished by its smaller, nearly cylindrical and proportionally stouter branches, while in zoecial structure it differs in having decidedly broader interzoecial spaces, causing the zoecial apertures to be much smaller. *A. shafferi* agrees better in the external appearance of its zoecia, but differs decidedly in the greater size of its segments and in their broader, relatively shorter, more frequent, and compressed lateral branches.

*Occurrence*.—Not uncommon in the lowermost strata of the Mount Hope member at Cincinnati, Ohio, and vicinity.

#### ARTHROPORA CLEAVELANDI (James).

Plate III, figs. 13-16; plate IV, fig. 6.

*Ptilodictya cleavelandi* JAMES, Paleontologist, No. 5, 1881, p. 38.

*Arthropora shafferi-cleavelandi* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 171.

*Ptilodictya grahami* JAMES, Paleontologist, No. 5, 1881, p. 39.

*Ptilodictya dubia* JAMES, Paleontologist, No. 5, 1881, p. 40.

*Ptilodictya cleavelandi* James, as shown by the type, is founded upon segments of a rather well-marked species of *Arthropora* occur-

ring abundantly throughout the various subdivisions of the Eden shale. The species is characterized by slender, generally nonbifurcating segments (in consequence of which the complete zoarium must have consisted of comparatively only a few rigid branches), and by the numerous and small lateral branchlets springing out at nearly right angles from the main stem. The segments are usually found separated, specimens retaining more than a sequence of two or three being extremely rare. In length they vary but little from the average of 7 mm. The basal segment is bifurcated and drawn out acuminate below.

The types of *P. grahami* and *P. dubia* agree exactly in their zoecial characters with those of *P. cleavelandi* and differ from the last only in each having a long striated pointed base and fewer or no lateral branchlets. As here interpreted these three supposed species are founded in two cases upon nothing further than basal segments and in the third case upon the upper segments of one and the same species of *Arthropora*, for which the name *cleavelandi* is adopted and the other two rejected.

*Occurrence*.—Eden shale, Cincinnati, Ohio, and vicinity.

#### ARTHROPORA KENTUCKYENSIS (James).

Plate IV, fig. 5.

*Ptilodictya kentuckyensis* JAMES, Paleontologist, No. 5, 1881, p. 38.

Compare *Arthropora bifurcata* ULRICH, Geol. and Nat. Hist. Surv. Minn., Final Rep., III, Pt. 1, 1893, p. 178, pl. xiv, figs. 22-25.

The types of *Ptilodictya kentuckyensis* James consist of two fragmentary examples of a species of *Arthropora*, which may prove to be closely related to the Minnesota Black River form described by Ulrich<sup>a</sup> as *Arthropora bifurcata*. Better and more complete examples are necessary before this relationship can be determined with certainty. In the meantime both James's and Ulrich's names may be recognized as valid. James's type specimens differ from other species of *Arthropora* in having exceptionally narrow interzoecial spaces. This character, if constant, may very well be regarded as of specific importance.

The jointed, bifoliate zoarium will distinguish *A. kentuckyensis* from all associated bryozoa. With the exception of *A. bifurcata*, the other species of *Arthropora* are too different to require comparison.

*Occurrence*.—Bromley shale of the Trenton, Ohio River bank opposite Cincinnati, Ohio, in strata 10 or 15 feet above low watermark.

#### ARTHROSTYLUS TENUIS (James).

*Helopora tenuis* JAMES, Paleontologist, No. 1, 1878, p. 3.

*Arthronema tenuis* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 160, pl. vi, figs. 8-8c.

*Arthrostylus tenuis* ULRICH, Geol. and Nat. Hist. Surv. Minnesota, Final Rept., III, Pt. 1, 1893, pl. iii, fig. 16c.

<sup>a</sup> Geol. and Nat. Hist. Surv. Minn., Final Rep., III, Pt. 1, 1893, p. 178.

Although the original description of this fine species is incorrect in several details, the study of the types shows that it was correctly identified and well illustrated by Ulrich in 1882.<sup>a</sup>

The zoarium is jointed, but specimens showing the segments still in connection are not common. The segments are very slender, straight, needle-shaped rods, about 5 mm. in length, slightly expanding toward the obtusely rounded upper extremity. The latter articulates with the pointed lower ends of generally two succeeding segments, the complete zoarium appearing to consist of extremely delicate and regularly bifurcating branches. Cross sections of a segment are subquad-rangular in shape, three of the sides being concave and equal in width, while the fourth side is slightly convex and half again as wide. Each of the three equal sides bears a row of zoecia, while 6 to 8 longitudinal striæ mark the fourth side. The zoecial apertures are oval, and when perfect have a delicate and prominent equally elevated rim; 9 zoecia in 2 mm.

The small slender segments of *A. tenuis* with the three equal celluliferous sides and the broader, striated, noncelluliferous fourth side are so different from the zoaria of all other bryozoa in the Cincinnati series that comparison is not necessary.

*Occurrence.*—Not uncommon throughout the Eden shale at Cincinnati and vicinity. James's type is from the lower division (Economy member) where specimens are particularly abundant.

#### ASPIDOPORA CALYCULA (James.)

Plate I, figs. 8-10.

*Lichenalia ? calycula* JAMES, Catal. Foss. Cincinnati Group, 1871, p. 5 (not defined).

*Charites ? calyculus* JAMES, Introd. Catal. Foss. Cincinnati Group, 1875, p. 1.

*Monticulipora (Diplotrypa) calycula* NICHOLSON, Genus Monticulipora, 1881, p. 165, pl. iv, figs. 4-4b.

*Monticulipora calycula* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 167.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 184.

*Aspidopora calycula* ULRICH, Geol. and Nat. Hist. Surv., Minnesota, Final Rept., III, Pt. 1, 1893, p. 255.

Most of the characters of this species have been so well described and illustrated by Nicholson that its identification is a matter of little difficulty. New figures of the internal structure are introduced here partly to show the identity of James's types with the form described by Nicholson, but mainly to give a better illustration of a vertical section than has been published heretofore. In the vertical section figured by Nicholson the zoarium is cut in such a way that a false idea of the internal features is presented. Such sections, in order to bring out the essential characters, should cut the zoarium at right angles to the growing edge. *A. calycula*, when sectioned in this way, shows

<sup>a</sup> Geol. and Nat. Hist. Surv. Minn., Final Report, III, Pt. 1, 1893, pl. iii, fig. 16e.

that an immature zone is present as in nearly all Paleozoic bryozoa, but this region is so short that it will not be noticed unless the section is made in the manner indicated above. Numerous acanthopores and closely tabulated mesopores are developed in the mature region, while each zoecium generally shows a single large cystiphragm occupying the bend from the immature to the mature region. Rarely a second and even a third may be developed above the first.

*Aspidopora calycula* is the only described species of the genus occurring in the particular strata in which it is found, while from associated bryozoa the discoid zoarium with numerous mesopores and acanthopores and the zoecial tubes with large cystiphragms will serve as a ready means of separation.

*Occurrence.*—Not uncommon in the Bromley shale of the Trenton, exposed along the Ohio River bank opposite Cincinnati, Ohio.

#### ASPIDOPORA ECCENTRICA (James).

Plate M, figs. 8-12; plate V, figs. 7, 8.

*Monticulipora (Heterotrypa?) eccentrica* JAMES, Paleontologist, No. 6, 1882, p. 48; No. 7, pl. I, figs. 6, 6a.

*Monticulipora eccentrica* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 167, pl. II, figs. 2a-c.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 185.

*Aspidopora eccentrica* ULRICH, Geol. and Nat. Hist. Surv., Minnesota, Final Rept., III, Pt. 1, 1893, p. 255.

Zoarium a small, free, subcircular expansion averaging 4 mm. in diameter and 1 mm. or less in thickness. Occasionally several of these disks may be found in contact and forming a zoarium as in *A. areolata* Ulrich. Celluliferous face smooth, slightly convex, and showing that the zoarium is composed of a single macula surrounded by zoecia of the normal size. Under surface flat or concave and lined with an epithelial membrane whose wrinkles or lines of growth are arranged about a point nearer the margin than the center of the base. Zoecial apertures rounded or ovate, the average diameter of the ordinary zoecium 0.3 mm. with 6 in 2 mm. while the largest zoecia of the maculae attain a diameter half again as great. Mesopores rather numerous, 6 usually surrounding a zoecium and occupying the interspaces left by the zoecia where their walls fail to touch. Acanthopores few and small and seldom detected either in sections or on the specimens.

The internal characters of this form differ but little from other species of the genus. The large, elongate but few cystiphragms and the absence of diaphragms characterize the zoecial tubes while the mesopores are, as usual in this genus, closely tabulated.

This neat little species can readily be recognized by its small subcircular zoarium and the eccentric wrinkles of the epithecated side. The species seems to be restricted to the middle division of the Eden shale in the Cincinnati area. Washings from certain shale beds will often

yield hundreds of free examples while the limestone layers sometimes show an abundance of specimens on their surfaces. The best development of the species at Cincinnati occurs in the shales at a horizon 170 feet above low water mark in the Ohio River.

*Occurrence.*—Southgate member of the Eden shale, Cincinnati, Ohio, and vicinity.

#### BATOSTOMA VARIANS (James).

*Chaetetes varians* JAMES, Paleontologist, No. 1, 1878, p. 2.

*Monticulipora* (*Chaetetes*) *variens* JAMES, Paleontologist, No. 5, 1881, p. 36.

*Monticulipora varians* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 177, pl. II, figs. 4a, b.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 199.

*Batostoma varians* NICKLES and BASSLER, Bull. U. S. Geological Survey, No. 173, 1900, p. 179.

*Batostoma variable* (part) ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 460, pl. xxxv, figs. 4b-4e (not 4, 4a, 5, or pl. xxxvi, fig. 1).

The earliest description of this species was sufficient for its recognition especially since it was compared with *Chaetetes* (now *Batostoma*) *jamesi* Nicholson, of which good figures and a description had appeared some years before. James's description of 1881 also gives a fair idea of the form and comparisons with the related *B. jamesi*. Ulrich's definition and figures of *Batostoma variable*<sup>a</sup> prove upon further investigation to be founded upon at least two distinct species of *Batostoma*, one of which as indicated above is synonymous with *B. varians*, while the second is here recognized and redefined as *B. variable*. The geological occurrence of the two species is quite different, *B. varians* ranging from the Arnheim formation to and through the Whitewater formation of the Richmond group, and *B. variable* being a characteristic fossil of the uppermost beds of the same group.

Comparing *B. varians* with *B. jamesi*, the former is found to have thin-walled, angular, instead of oval, thick-walled zoecia, few and irregularly placed instead of numerous mesopores, fewer diaphragms, and a lobate or subfrondescent zoarium instead of a regularly ramose one as in the latter species. For good figures of both the internal and external characters of *B. varians*, the student is referred to those mentioned above under the citation of *B. variable*.

*Occurrence.*—Abundant in the Arnheim, Waynesville, Liberty, and Whitewater formations of the Richmond group in Ohio, Indiana, and Kentucky.

#### BATOSTOMA VARIABLE Ulrich (restricted).

Plate VII, figs. 9, 10.

*Batostoma variable* (part) ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 460, pl. xxxv, fig. 5; pl. xxxvi, fig. 1 (not pl. xxxv, figs. 4b-4e=*B. varians*).

As mentioned in the remarks under the preceding species, Ulrich's *Batostoma variable* includes at least two distinct forms, one of which

<sup>a</sup>Geol. Surv. Illinois, VIII, 1890, p. 460.

is the same as *Batostoma varians* (James), while the second is a good species of the same genus. The writer proposes to restrict the species *Batostoma variabile* to the second form. Illustrations of the external features of this form have already been published by Ulrich, as cited above, and figures of the internal structure are given on Plate VII of this article.

*B. variabile*, as thus restricted, forms robust, cylindrical or subcompressed usually infrequently dividing stems, 10 mm. or more in diameter. The surface of the zoarium is smooth but maculae of conspicuously larger zoecia are present. The zoecia are thin-walled and angular at the surface with mesopores practically absent. Below the surface the zoecial walls are so thickened by deposits of tissue along their sides that a tangential section through this region gives a rounded aspect to the apertures. Six to seven of the ordinary zoecia occur in 2 mm. Acanthopores sometimes large and occupying all the zoecial angles, but at other times not a conspicuous feature. Distribution of diaphragms and other internal features as shown on Plate VII.

Because of the absence of mesopores, this species shows with unusual distinctness in tangential sections, the black line separating the walls of contiguous zoecia, a characteristic feature of this as well as a number of other genera of the monticuliporoids. The large, smooth, ramose zoarium, angular contiguous zoecia, few mesopores, and conspicuous clusters are characters sufficient to distinguish this form from other species of the genus.

The specimens figured by Ulrich from the Richmond group at Savannah, Illinois (Plate XXXV, figs. 4, 4a, in the work cited above) can not be determined with certainty on account of their ill-preserved internal structure, but it is probable that they belong to neither of the two species under discussion.

*Occurrence*.—Uppermost beds of Richmond group at a number of localities in Indiana and Ohio. The types which are in the collections of the U. S. National Museum, were found in the vicinity of Osgood, Indiana.

#### BYTHOPORA ARCTIPORA (Nicholson).

Plate II, figs. 1, 2.

*Ptilodictya ? arctipora* NICHOLSON, Ann. Mag. Nat. Hist. (4), XV, 1875, p. 180, pl. xiv, figs. 4-4b.

*Ptilodictya ? arctipora* NICHOLSON, Geol. Surv. Ohio, Pal., II, 1875, p. 262, pl. xxv, figs. 9-9b.

*Bythopora arctipora* MILLER and DYER, Contr. to Pal., No. 2, 1878, p. 6.

*Chaetetes minutus* JAMES, Paleontologist, No. 3, 1879, p. 20.

The types of *Chaetetes minutus* James consist of a number of specimens of a small species of *Bythopora*. Carefully compared with other species of this genus, they all prove to be more or less youthful branches of the same species of which Nicholson had previously

described<sup>a</sup> very old examples under the name *Ptilodictya? arctipora*. This determination was quite unexpected since in their revision of the Monticuliporoids James and James, who might be expected to know the facts in the case and therefore were followed by Nickles and the writer,<sup>b</sup> place *C. minutus* as a synonym of *Monticulipora* (now *Bythopora*) *delicatula* (Nicholson).<sup>c</sup>

*Occurrence.*—*Bythopora arctipora* is a characteristic and very abundant fossil of all the divisions of the Eden shale in the Ohio basin. The types of *C. minutus* were found near Loveland, Clermont County, Ohio.

#### BYTHOPORA DENDRINA (James).

*Helopora dendrina* JAMES, Paleontologist, No. 1, 1878, p. 3 (July 2, 1878); No. 2, p. 14.

*Bythopora dendrina* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 185.

*Bythopora fruticosa* MILLER and DYER, Contr. to Pal., No. 2, 1878, p. 6. pl. iv, figs. 6, 6a (July 22, 1878).

The type of *Helopora dendrina* does not belong to the James collection and the following remarks are introduced here only to indicate the rather unusual history of the species. As indicated in the above synonymy, James's species antedates *B. fruticosa* by only twenty days, but both names seem to be founded upon the same specimen. The specimen described by James was an unusually fine zoarium found by Mr. Charles Schuchert, who, after James's description had been written, disposed of it to Mr. C. B. Dyer. The type of *B. fruticosa* came from Mr. Dyer's collection, and apparently is the same specimen as that found by Mr. Schuchert, the result being that the two names have not only been founded upon the same species, but probably also upon the same specimen.

*B. dendrina* may be distinguished from other species of *Bythopora* by its frequently branching, slender stems; James's description brings out the superficial characters even though unaccompanied by illustration.

*Occurrence.*—Fairview formation, Cincinnati, Ohio, and vicinity.

#### BYTHOPORA GRACILIS (Nicholson.)

*Chaetetes gracilis* JAMES, Catal. Low. Sil. Foss. Cincinnati Group, 1871, p. 3 (named only).

*Chaetetes gracilis* NICHOLSON, Quar. Jour. Geol. Soc. London, XXX, 1874, p. 504, pl. xxix, figs. 7, 7a; Geol. Surv. Ohio, Pal., II, 1875, p. 198, pl. xxi, figs. 8, 8b.

*Monticulipora (Heterotrypa) gracilis* NICHOLSON, Genus Monticulipora, 1881, p. 125, pl. ii, figs. 1-1b, and fig. 20.

<sup>a</sup> Geol. Surv. Ohio, Pal., II, 1875, p. 262.

<sup>b</sup> Bull. U. S. Geological Survey, No. 173, 1900, p. 184.

<sup>c</sup> *Chaetetes delicatulus* Nicholson, Quart. Jour. Geol. Soc. London, XXX, 1874, p. 505, pl. xxix, figs. 8-8b.

*Monticulipora gracilis* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 173.

*Monticulipora gracilis* J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 191.

*Batodromella gracilis* ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 432, pl. xxxv, fig. 2.

*Bythopora gracilis* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 185.

This species among others was merely named by James but described and accredited to him by Nicholson. As in this and other similar cases, the James name is a *nomen nudum*, so that the real author of the species is Nicholson. The species has been well described and figured by Nicholson and Ulrich, and the student is referred to the works above cited for their detailed descriptions.

*Occurrence*.—Abundant in the Fairview and McMillan formations throughout the Ohio Basin. The species is especially abundant in the Corryville member, many slabs from this division being covered with their white, smooth, narrow branches.

#### BYTHOPORA MEEKI (James).

*Chaetetes meeki* JAMES, Paleontologist, No. 1, 1878, p. 1.

*Monticulipora (Chaetetes) meeki* JAMES, Paleontologist, No. 5, 1881, p. 35.

*Monticulipora gracilis* var. *meeki* NICHOLSON, Genus *Monticulipora*, 1881, p. 127.

*Monticulipora meeki* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 174.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 192.

*Bythopora meeki* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 186.

The type lot of *Chaetetes meeki* James contains, besides the well-known form regarded by Nicholson as a variety of *Monticulipora gracilis*, specimens of *Rhombotrypa quadrata* (Rominger), *Homotrypa communis* Bassler, an undetermined species, and a ramose example of *Homotrypa flabellaris* Ulrich. All of these species agree in but one feature, the general form of the zoarium, and also show how little value can be attached to this character alone. Strangely enough with such a mixture, James's descriptions are correct since he recognizes the relationship of his species with *Chaetetes* (now *Bythopora*) *gracilis* and gives good comparisons between the two forms. Evidently he based his remarks upon a few of his "types" and these happened to be of the species now recognized as *Bythopora meeki*.

The various species of *Bythopora* are so much alike in internal structure that it is not strange that Nicholson considered the species under discussion only a variety of his *Monticulipora gracilis*. However, the fact that it occupies and is characteristic of a different geological horizon, and always forms a considerably larger zoarium, seems to me reason enough for its rank as a distinct species. *Bythopora gracilis* forms long slender stems seldom over 3 mm. in diameter and characterizes the Fairview and McMillan formations, while the

branches of *B. meeki* are seldom less than 6 or 7 mm. in diameter, and occur only in the Waynesville formation of the Richmond group.

*Occurrence*.—Waynesville formation, Richmond group, at most localities in the Ohio Basin. James's types were from Clinton and Warren counties, Ohio.

#### BYTHOPORA PARVULA (James).

Plate III, figs. 11, 12; plate V, fig. 4.

*Helopora parvula* JAMES, Paleontologist, No. 1, 1878, p. 3.

*Bythopora parvula* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 186.

The types of *Helopora parvula* are from the upper part of the Eden shale, and prove to represent a form of *Bythopora* quite distinct from other species of this genus. The following description and comparison bring out its essential features.

Zoarium consisting of very slender cylindrical branches seldom exceeding 0.4 mm. in diameter, dividing at irregular but rather long intervals and bearing 4 or 5 rows of elongate oval zoecia rounded behind and drawn out in front, separated from each other longitudinally by spaces equal to their longer diameter. Measuring lengthwise about 5 zoecia in 2 mm. Narrow, channeled interspaces separate the rows of zoecia. Mesopores and acanthopores obsolete or apparently wanting. Diaphragms sparingly developed.

In its internal characters the species simulates *Nematopora*, but the proportionally much greater length of the zoecial tubes is regarded as indicating the trepostomatous genus *Bythopora* rather than the *Cryptostomata*.

Compared with other species of *Bythopora*, the present form may be easily distinguished by its extremely slender branches and widely separated zoecial apertures. The associated *B. arctipora* has broader branches and more closely set zoecia and well developed acanthopores in greater or less abundance.

*Occurrence*.—McMicken member of Eden shale, Loveland, Ohio.

#### CALLOPORA MULTITABULATA (Ulrich).

Plate I, figs. 5-7.

*Monticulipora kentuckensis* JAMES, Paleontologist, No. 7, 1883, p. 57, pl. II, figs. 1-1b.

*Monticulipora kentuckensis* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 180, pl. II, figs. 6a-d.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 203.

*Monotrypella multitabulata* ULRICH, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, 1886, p. 100.

*Callopora multitabulata* ULRICH, Geol. and Nat. Hist. Surv. Minnesota, Final Rept., III, Pt. 1, 1893, p. 280, pl. XXIII, figs. 11, 12, 16, 17, 24-26, 30, 31.

*Monticulipora kentuckensis* James could certainly never be recognized from any of the descriptions or figures given by its author.

The descriptions bring out no distinctive characters and the figures, especially of the internal structure, are inadequate and indeed quite incorrect. Figs. 5-7 on Plate I faithfully present the characters shown in the sections originally used and figured by James and James. A comparison of the two sets of figures will show decided differences.

James's types prove to be the same as the Kentucky form of the species well described by Ulrich as *Monotrypella multitabulata*.<sup>a</sup> However, since James's description and figures, as already stated, are wholly inadequate and incorrect in the most essential features, it clearly falls into synonymy under the rules cited on a previous page.

*Occurrence*.—Abundant in the Lexington limestone of the Trenton at a number of localities in Kentucky. James's types were found at Paris, Kentucky, but were erroneously recorded as coming from the Cincinnati group.

#### CALLOPORA ONEALLI (James).

Plate VI, figs. 1, 2.

*Chaetetes* ? *o'nealli* JAMES, Introd. Catal. Low. Sil. Foss., 1875, p. 2.

*Monticulipora o'nealli* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 174.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 194.

*Callopora onealli* MILLER, North American Geol. Pal., 1889, p. 296.

Not *Monticulipora* (*Heterotrypa*) *o'nealli* NICHOLSON, Genus *Monticulipora*, 1881, p. 118 = *Callopora onealli sigillarioides* (Nicholson).

The lower third of the Eden shale wherever exposed in the Ohio Basin generally contains a small species of *Callopora* in abundance. The same formation, especially the upper third, affords great numbers of two well-marked varieties. The small, earlier form of this species was first described by James in 1875, as above cited, under the name of *Chaetetes* ? *o'nealli* but figures were never published. In 1882, the same author distinguished one of the varieties as *Monticulipora* (*Heterotrypa*) *onealli* ? var. *communis*. The other variety is the same as the form described in 1875 by Nicholson under the name *Chaetetes sigillarioides*.<sup>b</sup> In the "Genus *Monticulipora*," Nicholson abandoned his species, believing it to be identical with *C. onealli*. Nickles and Bassler in their Synopsis proposed the arrangement of these forms as given in this paper, namely, recognizing *C. onealli* as a distinct species with the two varieties *communis* and *sigillarioides*.

The zoarium of *C. onealli* is of narrow, frequently dividing branches 1.5 to 2.0 mm. in diameter, often anastomosing so as to form a small bushy clump. The zoecia, of which 5 to 6 occur in 2 mm., are oval and separated by more or less numerous mesopores. Variety *communis* has the same zoarial growth, but its branches are much more robust, their average diameter being 7 mm. Its zoecia also are polygonal

<sup>a</sup> Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, 1886, p. 100.

<sup>b</sup> Pal. Ohio, II, 1875, p. 203, pl. xxii, figs. 9, 9a.

and in contact at the surface because of the scarcity of mesopores in this region. The zoecial characters of variety *sigillarioides* are the same as in the typical form, but the zoarium differs in consisting of rather long, graceful branches, 4 or 5 mm. in diameter, dividing less frequently and not tending to anastomose.

The internal structure of *C. onealli* is essentially the same as that figured by Nicholson in 1881<sup>a</sup> for the variety *sigillarioides*, but tangential sections of variety *communis* differ from both in showing few mesopores and polygonal zoecia.

*Occurrence.*—*C. onealli* is particularly abundant in the Economy member of the Eden shale in the vicinity of Cincinnati; variety *sigillarioides* ranges through the formation in equal abundance while variety *communis* is best developed in the upper (McMicken) member of these rocks.

#### CALLOPORA ONEALLI COMMUNIS (James).

Plate I, fig. 13; plate IV, figs. 8, 9.

*Monticulipora (Heterotrypa) onealli?* var. *communis* JAMES, Paleontologist, No. 6, 1882, p. 47; No. 7, 1883, pl. I, fig. 8.

*Monticulipora communis* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 175, pl. II, figs. 5a, b.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 195.

*Callopora onealli-communis* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 190.

This variety has been discussed in the remarks under *Callopora onealli* and, as there stated, may be distinguished from the typical form of the species by its decidedly robust instead of delicate branches and by its few mesopores. The branches are usually about 7 mm. in diameter and form bushy masses by their anastomosis. The internal structure is the same as in *C. onealli* and var. *sigillarioides* with the exception that as the surface is approached many of the mesopores pinch out so that at the surface itself the zoecia are in contact practically on all sides. This causes the zoecia to assume a polygonal outline and to become a trifle larger than in typical *C. onealli*. They are also larger than in the variety *sigillarioides*, but the average number of zoecia in a given space is the same in all three forms.

The types of the variety *communis* are missing, but the examples here figured on Plate IV are identical with specimens labeled by Mr. James in the collections of the U. S. National Museum.

*Occurrence.*—Abundant in the Eden shale at many localities in the Ohio Basin, Cincinnati being the type locality. Especially fine specimens are found in the upper beds of this formation.

<sup>a</sup>Genus *Monticulipora*, 1881, p. 118, pl. III, figs. 3–3f.

## CALLOPORELLA CIRCULARIS (James).

*Monticulipora (Heterotrypa) circularis* JAMES, Paleontologist, No. 6, 1882, p. 46.

*Monticulipora circularis* JAMES, Paleontologist, No. 7, 1883, p. 58, pl. 1, figs. 3, 3a.

*Monticulipora lens* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 165.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 181. (Not *Nebulipora lens* McCoy.)

*Calloporrella harrisi* ULRICH, Jour. Cincinnati Soc. Nat. Hist., VI, 1883, p. 91, pl. 1, figs. 5-5c.

*Calloporrella circularis* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 193.

James's original description of this form is clear enough to make one reasonably certain that his species is the same as that described and figured shortly after by Ulrich as *Calloporrella harrisi* and an examination of the type specimens of each proves this beyond a doubt. The absence of figures in the case of *M. circularis* is not a valid excuse for rejecting the name, inasmuch as the description gives a clear statement of both the internal and external characters. James and James in 1888 and J. F. James again in 1894 recognize *M. circularis* as a synonym of McCoy's *Nebulipora lens*—a species from Great Britain which has a similar zoarial growth, but whose zoecial characters are not yet known. The possibility of the two forms proving to represent the same species is, in the opinion of the writer, very remote.

Ulrich has given a good description and figures of the species and the student is referred to his work. The discoid zoarium, with rounded zoecia surrounded by ring-like walls and separated by numerous closely tabulated mesopores, characterize the species.

*Occurrence*.—Not uncommon in the Waynesville formation of the Richmond. The type locality is Westboro, Ohio, but the species has been found at many other places in southwestern Ohio and southeastern Indiana.

## CERAMOPORA CONCENTRICA James.

*Ceramopora concentrica* JAMES, Paleontologist, No. 1, 1878, p. 5.

*Ceramopora concentrica* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 38, pl. 1, figs. 8, 8 a.

Not *Cæloclema concentricum* NICKLES and BASSLER, Bull. U. S. Geol. Surv. No. 173, 1900, p. 212 (= *Cæloclema (Diamesopora) commune* (ULRICH)).

The original description of this form is too vague for recognition, and the species must date from 1883, when James and James gave another description and figured a specimen. The type lot, from which the original description was apparently drawn, consists of the following:

(1) Three specimens of *Ceramoporella distincta* Ulrich from the Eden shale at Cincinnati or vicinity.

(2) Two specimens of *Ceramoporella ohioensis* (Nicholson) from the upper beds of the Eden shale at Cincinnati.

(3) One specimen of the basal expansion of *Chiloporella flabellata* (Ulrich) from the Corryville member at Cincinnati.

(4) Several specimens of the basal expansion of *Coeloclema commune* (Ulrich) and fragments of the branches of the same species, all of these being from the lower part of the Eden shale, and probably from the bank of the Ohio River at Ludlow, Kentucky.

The specimen selected for illustration by James and James,<sup>a</sup> and which should be adopted as the real type of the species, is a robust, frequently branching specimen of *Callopora oncalli-sigillarioides* (Nicholson) overgrown by a finely preserved example of *Ceramoporella ohioensis* (Nicholson).<sup>b</sup> This specimen was found in the upper beds of the Eden shale, near Eden Park reservoir, Cincinnati. *Ceramopora concentrica* James and James, therefore, as based on the figured type, is a synonym for *Ceramoporella ohioensis* (Nicholson). Without the specimen it would be impossible to make this determination, since the figure is wholly without distinctive characters. As stated, the original description is too indefinite, and, as the type lot shows, based upon too many distinct species for recognition.

Nickles and the writer in their Synopsis of American Fossil Bryozoa referred James's *Ceramopora concentrica* to the genus *Coeloclema*, making Ulrich's *Diamesopora communis* a synonym. How erroneous our ideas of the species were is shown by the above remarks, our conception of the species being based upon a "typical" specimen received by Mr. Nickles some years ago from Mr. James, and which happened to be the same as Ulrich's *Diamesopora* (now *Coeloclema*) *communis*. Hence *Coeloclema concentricum* of Nickles and Bassler is a synonym of *Coeloclema commune* (Ulrich).

#### CERAMOPORA ? IRREGULARIS James.

*Ceramopora ? irregularis* JAMES, Paleontologist, No. 1, 1878, p. 5.

This species was described as incrusting foreign substances and having cells similar to those of *Chaetetes jamesi* Nicholson. The similarity to the species mentioned is borne out by the type specimens, inasmuch as three of the type lot are typical ramose examples of *C.* (now *Batostoma*) *jamesi* and four are incrusting forms of the same species, while the remaining specimen represents the parasitic base of *Batostoma implicatum*.

The variation in the shape of the zoecia which suggested the specific name is due either to growth over an uneven surface or to indentations of the zoecial walls caused by the development of numerous acanthopores. Instead of being a synonym of *B. implicatum*, as stated by Nickles and Bassler, the name should have been placed as

<sup>a</sup> Jour. Cincinnati Soc. Nat. Hist., XI, 1888, pl. 1, figs. 8, 8a.

<sup>b</sup> *Ceramopora ohioensis* Nicholson, Pal. Ohio, II, 1875, p. 265, pl. xxv, figs. 10a, b, c (not 10 c, d).

synonymous in part with both *B. jamesi* and *B. implicatum*. However, the original and only diagnosis is so vague that for that reason alone the name ought to be dropped.

#### CERAMOPORA NICHOLSONI James.

*Ceramopora nicholsoni* JAMES, Catal. Foss. Cincinnati Group, 1875, p. 3.

*Monticulipora* (*Fistulipora*) *nicholsoni* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 34, pl. 1, figs. 6-6c.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1896, p. 121, fig. 12.

Not *Chiloporella nicholsoni* NICKLES and BASSLER, Bull. U. S. Geol. Survey, No. 173, 1900, p. 207 (= *Chiloporella flabellata* ULRICH).

This species was first described by James as "incrusting foreign substances." The type species, however, is not an incrusting form but is a solid flabellate expansion, and that this specimen is the one used by James for his description is attested by the label in his handwriting accompanying it. The name *C. nicholsoni* therefore, being founded on characters which do not belong to the specimen, following the laws of nomenclature, must be abandoned.

James's type is an example of *Fistulipora flabellata* described by Ulrich in 1879. In 1879 James also described the two species, *F. multipora* and *F. siluriana*, but in the James and James revision of the *Monticuliporidae* in 1888, these two names, together with Ulrich's *F. flabellata* and also *Callopora cincinnatiensis* of the same author were made synonyms of *C. nicholsoni*. The respective types of *F. multipora* and *F. siluriana*, as noted under these headings in this paper, contain a number of different species, while Ulrich's *Callopora cincinnatiensis*, the third supposed synonym which was erroneously described by its author as coming from Cincinnati, happens to be the same as *Lioclema occidens* (Hall and Whitfield) from the Upper Devonian of Iowa.<sup>a</sup>

Nickles and Bassler, believing that with the exception of *C. cincinnatiensis*, the synonymy given by James for *C. nicholsoni* was correct, recognized his species as *Chiloporella nicholsoni*, and placed Ulrich's well-defined *Chiloporella* (*Fistulipora*) *flabellata* as a synonym. Had they seen the types they certainly would not have fallen into this error, nor would such stress have been put upon "authentic" specimens had they known of the number of distinct forms often included among the specimens marked as the original types of one and the same species.

To sum up, the writer would now regard *Ceramopora nicholsoni* and its so-called synonyms as follows: (1) *Ceramopora nicholsoni* itself must be abandoned, since the species is founded upon characters not shown by the type. (2) *Fistulipora flabellata* Ulrich is recognized as a good species and as the type of the genus *Chiloporella*. (3) Both

<sup>a</sup>Geol. Surv. Illinois, VIII, 1890, p. 427.

*Fistulipora multipora* and *F. siluriana* are inadequately described and the types of each, moreover, include a number of distinct species. Therefore neither of the last two names is held as valid. (4) *Callopora cincinnatiensis* is a synonym for *Lioclema occidens* and has no relation at all with any of the Cincinnati bryozoa.

#### CERAMOPORA RADIATA James.

*Ceramopora radiata* JAMES, Paleontologist, No. 2, 1878, p. 12.

The type and only specimen described under this name proves to be a young example of *Ceramoporella granulosa milfordensis* (James) from the Eden shale at Cincinnati. The specimen consists of but a few maculæ with the zoecial apertures long-drawn out and radiating from them in a more marked degree than usual. A similar condition characterizes young specimens of all species of *Ceramoporella*. Consequently the radial arrangement depended upon in distinguishing the species should not be regarded as a valid specific character.

#### CERAMOPORELLA GRANULOSA MILFORDENSIS (James).

Plate VI, fig. 7.

*Callopora milfordensis* JAMES, Paleontologist, No. 2, 1878, p. 11.

*Monticulipora* (*Fistulipora*) *milfordensis* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 36, pl. 1, figs. 7-7b—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1896, p. 122.

*Ceramoporella granulosa milfordensis* NICKLES and BASSLER, Bull. U. S. Geol. Survey, No. 173, 1900, p. 200.

None of the descriptions or figures of this form is sufficient for its recognition, but I have adopted James's name in a subordinate sense to distinguish an abundant Eden shale variety of *Ceramoporella*. The specimens separated by James under the specific name *milfordensis* are of a *Ceramoporella* that ranges with certain slight but distinguishable modifications through all the subdivisions of the Covington and Richmond groups. The first recognizable description and figures of one of the varieties of this cosmopolitan species was published in 1890 by Ulrich<sup>a</sup> when he proposed the specific designation *C. granulosa* for the form occurring so abundantly in the shaly limestone of the Richmond group in northern Illinois. Variety *milfordensis* differs from the typical *C. granulosa* in having slightly smaller zoecia and in the very slight development of the peculiar granules that occur so abundantly in the Illinois types of the species. The zoaria of the latter also grow into much thicker and larger masses than those of the Eden shales variety.

Other forms of this general type were found in succeeding Cincinnati rocks. In course of time these probably will receive similar subordinate designations.

<sup>a</sup>Geol. Surv. Illinois, VIII, 1890, p. 466, pl. xli, figs. 2, 2<sup>a</sup>.

*Occurrence.*—The James types were found in the Eden shales at Milford, Ohio, but the variety occurs generally in abundance in the Ohio Basin wherever the strata mentioned are exposed.

**CERAMOPORELLA WHITEI (James),**

Plate V, fig. 6; plate VI, figs. 8-10.

*Ceramopora whitei* JAMES, Paleontologist No. 2, 1878, p. 12.

*Ceramopora ? whitei* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 38, pl. I, figs. 9, 9a.

*Ceramoporella whitei* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 201.

James recognized the relations of this species by comparing it in his original description with Nicholson's *C. ohioensis*.<sup>a</sup> The description and figures given by James and James in 1888 are practically worthless. The figure of the type agrees so little with the specimen itself that were it not for the presence of three cracks traversing it, one could not be certain of the identification. The view of the surface enlarged is also incorrect, as a comparison with a photograph of the same on Plate V will show. Fortunately the species has not been described under any other name, so that James's specific designation may be retained.

The zoarium forms thin crusts over foreign bodies, but by the superposition of numerous layers may become massive. Each zoarial layer is short, rarely exceeding 1.5 mm. in thickness. Surface smooth, the maculae or clusters of rather thick-walled mesopores not being elevated. Zoecia small, more or less angular, thin-walled and direct, about 7 in 2 mm. Mesopores generally few, sometimes absent altogether. Lunarium occupying from one-fourth to one-third of the zoecial circumference, seldom overarching the zoecial cavity and always a more or less inconspicuous feature of the surface. The internal structure is essentially the same as in other species of the genus and is more clearly brought out by the figures on Plate VI than would be possible by description.

As is the case in other species of the same section of *Ceramoporella*, *C. whitei* exhibits considerable variation. This consists principally of (1) differences in the relative number and distribution of the mesopores even in different or adjoining parts of the same zoarium, (2) in the degree in which the zoecia imbricate, and consequently (3) in the degree of obliquity of the apertures, and (4) in the extent to which the lunaria are developed in the zoecia occupying the maculae. However, the features presented by James's type are exhibited on at least a portion of nearly every one of several hundred specimens seen by the writer.

<sup>a</sup> *Ceramopora ohioensis* Nicholson, Pal. Ohio, II, 1875, p. 265, pl. xxv, figs. 10 a, b, c (not 10 c, d.).

*C. ohioensis*, a closely related species, may be separated by its uniformly more imbricating and radially arranged triangular-shaped zoecial apertures and conspicuous, over-arching lunaria.

*Occurrence.*—James's type came from the Corryville member at Cincinnati. The species is not uncommon and ranges from this bed to and through the various divisions of the Richmond group.

#### CHAETETES CRUSTULATUS James.

*Chaetetes crustulatus* JAMES, Paleontologist, No. 1, 1878, p. 1; No. 3, 1879, p. 20.

*Monticulipora crustulata* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 23, pl. 1, figs. 2, 2a.

*Monticulipora crustulata* J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 82.

The original description of this form is so general that it is impossible to determine which particular one of the four or five species found in the Cincinnati series incrusting Orthocerata was intended by its author. Indeed it is probable that he had no particular one in mind as the synonymy given later by James and James indicates.

The specimens upon which Mr. James founded his original diagnosis are not distinguished in the collection. The type specimen selected and figured in 1888 as *Monticulipora crustulata* is probably an example of *Spatiopora maculosa* Ulrich which had been accurately defined and figured by that author in 1883.<sup>a</sup> This identification, however, is based only on the general view of the zoarium,<sup>b</sup> the figure of the surface enlarged (fig. 2a) being almost certainly incorrect since the thickness of wall shown is not attained by any Cincinnati bryozoan known to me. This figured specimen is missing, but another example now marked as the type is *Spatiopora maculosa* Ulrich.

The name *Chaetetes crustulatus*, therefore, must be dropped since it was not defined exactly enough for recognition. *Monticulipora crustulata* although figured, can not be determined with certainty because of the poor illustrations and the absence of the type specimen.

#### CHAETETES LYCOPERDON James (not Hall).

*Chaetetes lycoperdon* JAMES Paleontologist, No. 2, 1878, p. 11.

*Chaetetes lycopodites* JAMES Paleontologist, No. 3, 1879, p. 20.

The specific names *lycoperdon* and *lycopodites* were employed by James for some massive Cincinnati bryozoan but which one can not be decided from his descriptions. His collection also now contains no specimen labelled with either of these names. It matters little, however, since so many species have been described by authors under the designation *Chaetetes lycoperdon* that the name, never having been restricted to any particular one, now has no standing.

<sup>a</sup> Jour. Cincinnati Soc. Nat. Hist., VI, 1883, p. 167, pl. vii, fig. 6.

<sup>b</sup> James and James, 1888, pl. 1, fig. 2.

**CHAETETES PETROPOLITANUS James (not Pander).**

*Chaetetes petropolitanus* JAMES, Paleontologist, No. 2, 1878, p. 11.

The Cincinnati form referred to as above by James is most certainly not the same as the European Ordovician species described by Pander. Which particular one of the massive or hemispheric forms James had in mind can not be determined. Possibly *Amplexopora petasiformis* (Nicholson) was the form intended, but the matter is of no consequence since the James identification of *C. petropolitanus* is unmistakably incorrect.

**CHAETETES SUBROTUNDUS James.**

*Chaetetes subrotundus* JAMES, Paleontologist, No. 2, 1878, p. 11.

*Astylospongia subrotundus* JAMES, Paleontologist, No. 5, 1881, p. 34.

*Microspongia ? subrotundus* J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XIV, 1891, p. 55, fig. 1.

The name under which this form was first described would lead one to believe it to be a bryozoan. Subsequently, as shown above, the form was regarded as a species of *Astylospongia* and later as *Microspongia*. There is little doubt that the specimens belong to one of the numerous forms or variations of *Hindia sphaeroidalis* Duncan. The type specimens of *C. subrotundus* were found at Ogden Station, Clinton County, Ohio.

**CHAETETES TURBINATUM James.**

*Chaetetes turbinatum* JAMES, Paleontologist, No. 2, 1878, p. 11.

*Monticulipora turbinata* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 161, pl. II, figs. 1 a-c.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XV, 1893, p. 158.

Not *Monotrypa turbinata* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 316 (= *Monotrypa subglobosa* Ulrich).

The name *Chaetetes turbinatum* was proposed tentatively in 1878 for specimens differing from *Chaetetes petropolitanus* in being turbinate in form and in having the basal attachment small. *C. turbinatum* was stated to range from the lowest to the highest exposed beds at Cincinnati and vicinity. Now just which one of the six or more massive bryozoa occurring in this range of strata at Cincinnati was considered as *Chaetetes petropolitanus* can never be accurately determined from the literature, and none of the specimens in the James's collection is labelled so as to indicate which form that author had in mind. This first reference to *Chaetetes turbinatum* is therefore of no value, the name being little more than a *nomen nudum*.

In 1879 Ulrich described *Chaetetes subglobosus*,<sup>a</sup> which James and James recognized as a synonym of their *C. turbinatum* in 1888,<sup>b</sup> when

<sup>a</sup> Jour. Cincinnati Nat. Hist., II, 1879, p. 129, pl. XI, figs. 11-11b.

<sup>b</sup> Idem., X, 1888, p. 161.

they figured and described their species for the first time, the original definition being merely a comparison with an incorrectly identified Cincinnati species. In the paper mentioned the latter authors figure two specimens which in the collection are labelled as the types of the species. These specimens agree in one character only, namely, the turbinate growth ascribed to the species by the authors. The zoecia of each, however, are so different in size, shape, and arrangement that a lens is not necessary to determine that the two specimens represent very distinct species. The original of fig. 1b<sup>a</sup> is a specimen of *Cyphotrypa acervulosa* (Ulrich),<sup>b</sup> a species hitherto known only from the Trenton. It is doubtful whether this specimen came from Cincinnati, as is stated by James. Still, it is possible that it was found in the Trenton strata exposed opposite Cincinnati along the banks of the Ohio River. The second figured type (fig. 1a of the article cited) is a typical example of *Monotrypa subglobosa* (Ulrich),<sup>c</sup> found only in the lower part of the Eden shales. Fig. 1c presumably is intended to represent the surface of one of the two types. No matter which one was chosen, the figure is incorrect, since both species have thin-walled, polygonal zoecia; with no mesopores in the case of the former and very few angular young cells in the latter. The figure shows rounded or irregular zoecial apertures with subcircular mesopores at their junction angles.

J. F. James in 1895 states, in his remarks under the description of *Monticulipora selwyni*, that *M. (Prasopora) selwyni* var. *hospitalis* Nicholson (now *Prasopora hospitalis*) is the same as *M. turbinata* (James), and that an examination of the internal structure of the two shows their identity beyond a doubt. This author evidently did not base his observations upon the figured types of *M. (Chaetetes) turbinata*, inasmuch as their internal structure, although different in each specimen, is totally distinct from Nicholson's species. Moreover, the last was described by the elder James as *Monticulipora winchelli*. To add to the confusion, Nickles and the writer very unwisely recorded, as cited above in the synonymy, *Chaetetes turbinatum* as a valid species of the genus *Monotrypa*, making Ulrich's *Monotrypa subglobosa* a synonym.

To sum up, the first definition of *Chaetetes turbinatum* is worthless, while the second is based upon two distinct species. These two forms, however, can not be correctly determined from the published figures, since the enlarged view of the surface—the only figure given that might be of any value—is an incorrect representation. Finally, a

<sup>a</sup> Jour. Cincinnati Soc. Nat. Hist., X, 1888, pl. 11.

<sup>b</sup> *Leptotrypa acervulosa* Ulrich, Geol. and Nat. Hist. Surv. Minnesota, Final. Rept., III, Pt. 1, 1893, p. 318, pl. xxvii, figs. 24, 25.

<sup>c</sup> *Chaetetes subglobosa* Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, 1879, p. 129, pl. xii, figs. 11-11b.

species with internal and also external characters different from either of the figured types is stated to have the same internal features. It is work of this character that is so disheartening to the conscientious student. That James's species does not deserve recognition need hardly be stated.

**COELOCLEMA ALTERNATUM (James).**

*Ceramopora alternata* JAMES, Paleontologist, No. 1, 1878, p. 5.

*Monticulipora (Fistulipora) alternata* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 34, pl. 1, figs. 5-5b.

*Coeloclema alternatum* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 212.

*Diamesopora raupeli* ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 468, pl. xxxix, figs. 3-3b; pl. xli, figs. 4-4c.

*Original description.*—"Polyzoary consisting of hollow, branching, cylindrical, or compressed stems from one to four lines in diameter, with irregular swellings; the hollows filled with foreign matter (clay). Cell apertures of the most perfect specimens, elevated, oblique, arched, subcircular, or oval; five or six in the space of a line, including the interspaces; generally arranged in alternating rows, sometimes in a diagonal manner around the branches. Spaces between the cells equal to their diameter, or a little more or less on different examples. Slightly cut longitudinal sections of some specimens show the cells arranged in diagonal, alternating rows of a lozenge-shape, with minute interstitial pores. Distributed over the surface about two lines apart are spots, sometimes slightly elevated, bearing fewer cell apertures and more or less of the small pores. The surface of worn or weathered examples—mostly so found—are nearly smooth; destitute in most cases of prominent cell mouths, but show more minute interstitial tubes and divisions than perfect specimens."

The characters of this species are well brought out in Mr. James's earliest description, quoted above, and there should be no difficulty in recognizing the form. The illustrations given by James and James in 1888 are of little value, and for a good description and trustworthy figures the student is referred to Ulrich's work in 1890.

The slender, hollow-stemmed branches, with thick-walled, oval zoecia arranged in diagonally intersecting lines and arched over by prominent hoods—the lunaria—causes the recognition of the species to be an easy matter.

*Occurrence.*—*C. alternatum* is found usually in great abundance wherever the Southgate and McMicken members of the Eden shale are exposed at Cincinnati, Ohio, and vicinity.

## COELOCLEMA OWENI (James).

Plate VI, figs. 5, 6.

*Fistulipora oweni* JAMES, Jour. Cincinnati Soc. Nat. Hist., VII, 1884, p. 21, fig. 2-2g.

*Monticulipora (Fistulipora) oweni* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 34.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1896, p. 119.

*Coeloclema oweni* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 212.

The hollow, contorted or utricular stems of this form are so different in growth alone from the other species of the genus that its identification is quite easy. The figures of the type specimen given by James are sufficient for the recognition of the species, but one of its most marked characteristics—an unusually prominent lunarium—has not been pointed out by its author. The lunaria are so strongly developed and sharply raised that the zoarial surface is fairly roughened by them. The lunarium is shown exceptionally well in tangential sections where the zoecia are seen to be so indented with it as to be bilobed. In shape the lunarium is semicircular with the ends pinched slightly together. The other internal characters are essentially the same as in the remaining species of *Coeloclema*.

*Occurrence*.—A characteristic and quite abundant fossil of the Mt. Auburn beds. Lebanon, Ohio, is the type locality, but Cincinnati, Ohio, Madison, Indiana, and other localities exposing this horizon, furnish specimens.

## DEKAYELLA ULRICHI (Nicholson).

Plate II, figs. 3, 4.

*Monticulipora (Heterotrypa) ulrichi* NICHOLSON, Genus Monticulipora, 1881, p. 131, fig. 22.

*Dekayella ulrichi* ULRICH, Jour. Cincinnati Soc. Nat. Hist., VI, 1883, pp. 91, 153.

*Monticulipora ohioensis* JAMES, Jour. Cincinnati Soc. Nat. Hist., VII, 1884, p. 137, pl. VII, figs. 1, 1a.—JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 183.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 207.

*Dekayella robusta* FOORD, Ann. Mag. Nat. Hist. (5), XIII, 1884, p. 341, pl. XII, figs. 2-2d.

*Dekayella ulrichi-robusta* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 228.

*Monticulipora ohioensis* was distinguished by its author from *M. ulrichi*, because (1) its interstitial tubes (mesopores) were less closely tabulated than those of the latter species; (2) it had a more robust habit of growth, and (3) conspicuous monticules were present. The first distinction is based on erroneous observation, since the tabulation of the mesopores of the types of *M. ohioensis* is precisely the same as in typical examples of *D. ulrichi* (see Plate II). The more robust growth and conspicuous monticules are characters of such minor importance that they are scarcely worthy of even varietal recognition.

Experience shows that this is true, especially in species of *Dekayella* and related genera of the *Heterotrypidæ*. Nicholson figured branches of his species with a smooth surface, but every variation from this to sharply monticulated examples may be found. Foord<sup>a</sup> described this sharply monticulated form as *Dekayella robusta* and Nickles and the writer, in their Synopsis, recognized his species as a variety of *D. ulrichi*, with James's name as a synonym. For the reasons mentioned, *D. robusta* is now regarded as not even of varietal importance.

*Occurrence*.—A characteristic and exceedingly common fossil in the Eden shale of most localities in the Ohio basin. The types of *M. ulrichi*, and also of *M. ohioensis* and *D. robusta* came from Cincinnati, Ohio.

#### DEKAYIA MACULATA James.

Plate II, figs. 13, 14.

*Dekayia maculata* JAMES, Paleontologist, No. 5, 1881, p. 36.

*Monticulipora* (*Dekayia*) *maculata* J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1896, p. 116, fig. 11.

This is one of the best marked species of the genus *Dekayia* and may easily be recognized from the figures published by J. F. James in 1896 (after an unpublished plate by Ulrich). The study of many specimens of this species has indicated that its principal specific character is not, as stated by both the elder and younger James, the presence of maculæ composed of mesopores alone. James's two typespecimens, it is true, show such maculæ in a marked degree, but in many other examples from the same bed and locality, otherwise indistinguishable, the maculæ are composed only of zoëcia larger than the average, and with other specimens every gradation between the two may be established. J. F. James states in his description (1896), "walls of corallites thin, internal structure unknown," and yet gives at the beginning of this same description, figures showing all of the internal characters, and particularly the unusually great peripheral thickening of the walls. This latter feature is the specific character which will readily separate *D. maculata* from other species of the genus.

The ramose zoarium, thick zoëcial walls, conspicuous acanthopores, few and delicate diaphragms and practical absence of mesopores together with the size of the zoëcia—8 in 2 mm.—form a combination of characters which will readily separate *D. maculata* from all associated bryozoa. Views illustrating the structure and thickness of the walls, the distribution of acanthopores, mesopores, and diaphragms, and other internal features are given on Plate II.

*Occurrence*.—Quite an abundant and characteristic fossil of the McMicken member of the Eden at Cincinnati and vicinity. James's types were from Loveland, Ohio.

<sup>a</sup> Ann. Mag. Nat. Hist. (5), XIII, 1884, p. 341.

**DICRANOPORA MEEKI (James).**

Plate V, fig. 1.

*Helopora meeki* JAMES, Paleontologist, No. 1, 1878, p. 3.

*Original description.*—"Polyzoary consisting of very small cylindrical or subcylindrical stems; sometimes branching dichotomously. About 6 cells in the space of a line measuring their longer axes, and arranged in rows between strong elevated longitudinal lines. The cells are generally opposite each other in the rows, but sometimes are alternating; cell apertures long oval, margins not raised; length of fragments observed from one-fourth to one-half an inch; diameter one-fifth of a line."

The original and only description of this species, quoted above, is good as far as it goes, but fails to state the two most important features, namely, that the zoarium is bifoliate and is also jointed. Its zoecial structure is that of the family *Rhinidictyonidae*, and this fact together with the jointed zoarium causes the reference of the species to the genus *Dicranopora*. As in all species of this genus, the zoarium of *D. meeki* consists of either simple or dichotomously branched segments with the lower end of each pointed for articulation and the upper end or ends excavated to receive the pointed extremity of the following segments.

*D. meeki* may be distinguished from all other species of *Dicranopora* by its comparatively long and extremely narrow segments, their average length being 5.8 mm. and width about .4 mm. Four rows of zoecia generally occupy each face of a segment, but sometimes only three are found.

*Occurrence.*—The species was listed by James as from Warren County, Ohio, but his label states Cincinnati as the locality for the type. Specimens occur often quite abundantly in the Mt. Hope member in the vicinity of Cincinnati.

**ESCHAROPORA ACUMINATA (James).***Ptilodictya acuminata* JAMES, Catal. Foss. Cincinnati Group, 1875, p. 3.*Escharopora acuminata* ULRICH, Geol. and Nat. Hist. Surv., Minnesota, Final Rep., III, Pt. 1, 1893, p. 167.Compare *Ptilodictya falciformis* NICHOLSON, Ann. Mag. Nat. Hist. (4), XV, 1875, p. 177, pl. XIV, figs. 1-1b.

The types of James *Ptilodictya acuminata* prove to be of a sword-shaped *Escharopora* from the Eden shales. To point out constant differences between this form and *Escharopora (Ptilodictya) falciformis* from the Fairview formation is very difficult if not impossible and James's name is adopted here as a convenient term for the Eden shale form of this type of *Escharopora* rather than as that of a good species. James distinguished his species from Nicholson's by its narrower and

relatively thicker form and more gradual expansion from the pointed striated base. These differences, however, are maintained only by his three type specimens. A larger number of specimens shows that the zoarium varies from narrow blades less than 2 mm. at their greatest width to sword-shaped fronds 6 mm. wide. However, specimens of the latter dimension are rare in the Eden shale, while the Fairview species is seldom of less width. *E. falciformis* is evidently a descendant and a more robust form of *E. acuminata*.

*Occurrence*.—Not uncommon in the Eden shale at Cincinnati and vicinity.

#### ESCHAROPORA HILLI (James).

*Ptilodictya hilli* JAMES, Paleontologist, No. 1, 1878, p. 4.

*Ptilodictya hilli* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, pl. vii, figs. 7, 7a.

*Ptilodictya hilli* NETTLEROTH, Kentucky Fossil Shells, 1885, p. 30, pl. xxxv, figs. 1, 2, 4, 5.

*Escharopora hilli* ULRICH, Geol. and Nat. Hist. Surv. Minnesota, Final Rep., III, Pt. 1, 1893, p. 162.

The specific character of this fine species was pointed out by Mr. James in his description as follows: "The marked and decided difference between this species and *P[tilodictya] falciformis* Nicholson lies in the prominent transverse ridges." The zoarium in this form, however, is usually wider and stronger than in *Escharopora falciformis*, but as already mentioned the transverse ridges are the most obvious difference. These ridges are formed by the elevated maculae, which are so transversely elongated that they become confluent.

*Occurrence*.—The type specimen is said to have been found on the bank of the Ohio River at Cincinnati. Evidently it was drifted here, inasmuch as the Fairview rocks have furnished all other specimens known to the writer. The type does not belong to the James collection, so whether it occurred *in situ* at Cincinnati in the Trenton outcrops along the river bank or was washed down from some geologically higher locality could not be determined.

#### ESCHAROPORA PAVONIA (D'Orbigny).

*Ptilodictya pavonia* D'ORBIGNY, Prodr. de Pal., I, 1849, p. 22.

*Monticulipora (Monotrypa) pavonia* NICHOLSON, Genus Monticulipora, 1881, p. 195, fig. 41, pl. vi, figs. 3, 3a.

*Stictopora clathratula* JAMES, Catal. Foss. Cincinnati Group, 1871.

*Chaetetes ? clathratulus* NICHOLSON, Quar. Jour. Geol. Soc. London, XXX, 1874, p. 509, pl. xxx, figs. 1-1b.

*Chaetetes ? clathratulus* NICHOLSON, Geol. Surv. Ohio, Pal., II, 1875, p. 209, pl. xxii, figs. 2-2b.

*Chaetetes clathratulus* NICHOLSON, Ann. Mag. Nat. Hist. (4), XVIII, 1878, p. 91, pl. v, figs. 9, 9a.

James's name *Stictopora clathratula* was published without description and is therefore a *nomen nudum*. As indicated above, Nicholson

described the species using James's specific name, and as his descriptions are based on typical *Escharopora paronia*, James's name is also made synonymous with this species.

D'Orbigny's species is distinguished from the other forms of *Escharopora* by its broad zoarium. It is a common fossil and is found at most localities in Ohio, Kentucky, Indiana, and Tennessee where the beds of the Fairview formation are exposed.

#### EURYDICTYA MULTIPORA (Hall?) Ulrich.

Plate I, figs. 11, 12.

*Phenopora multipora* HALL, Foster and Whitney's Rep. Geol. Lake Superior Land District, Pt. 2, 1851, p. 206, pl. xxiv, figs 1a, b.

*Phenopora? multipora* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 171, pl. VIII, figs. 7-7b.

*Eurydictya multipora* ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 520.

*Ptilodictya antiqua* JAMES, Paleontologist, No. 5, 1881, p. 37.

The type of *Ptilodictya antiqua* James is identical with the specimens figured and described by Ulrich in 1882<sup>a</sup> as *Phenopora? multipora* Hall. As admitted by Ulrich in 1893, an examination of the internal characters of Hall's type specimen is necessary before it can be positively stated that his identification is correct. Until this is done, the synonymy had best remain as given above. For the identification of the species, at least the Kentucky form, Ulrich's description and figures should be consulted.

*Occurrence.*—Hall's types were found in Trenton strata along the Escanaba River, Michigan, while those of James and Ulrich came from the Lexington limestone in the vicinity of Harrodsburg and Burgin, Kentucky, respectively.

#### FISTULIPORA? MULTIPORA James.

*Fistulipora? multipora* JAMES, Paleontologist, No. 1, 1878, p. 2.

In 1888 James and James decided that *Fistulipora multipora* James and *Chiloporella (Fistulipora) flabellata* Ulrich were synonymous with *Ceramopora nicholsoni* James published in 1875. The specimens in the James collection labelled as the types of *F. multipora*, however, consist of the following:

(1) Twenty-one specimens of *Ceramoporella distincta* Ulrich from the Eden shale at Cincinnati and vicinity.

(2) Six typical examples of *Chiloporella flabellata* Ulrich.

If the majority ruled in such cases, *F. multipora* would certainly not be a synonym of *C. nicholsoni* as decided by James. However, in view of the facts (1) that the name was placed in synonymy by its author, (2) that the types represent two distinct and well-defined species, and (3) that the original diagnosis is not only insufficient, but

<sup>a</sup> Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 171.

also would apply equally to most of the species of *Ceramoporella* and related genera, the name had better be abandoned. Further remarks on this species are given in the discussion of *Ceramopora nicholsoni*.

#### FISTULIPORA SILURIANA James.

*Fistulipora siluriana* JAMES, Paleontologist, No. 3, 1879, p. 19.

In the revision of the Monticuliporidae in 1888, James and James concluded that this species was a synonym of *C. nicholsoni* and represented a stage in which the intercellular spaces were thick and the interstitial cells few in number. The type lot contains typical specimens of the following:

(1) Four specimens of *Ceramoporella distincta* Ulrich from the Eden shale at Cincinnati or vicinity.

(2) One specimen of *Coeloclema commune* Ulrich from the Economy member.

(3) Two specimens of *Chiloporella flabellata* Ulrich from the Corryville member.

The original diagnosis is of little value, and moreover is not borne out by the majority of the type specimens, the first four specimens having thin-walled zoecia and rather numerous mesopores instead of the opposite. The same reason for abandoning the name may be invoked here as in the case of *F. multipora* and *C. nicholsoni*, both of which see for further remarks.

#### HELOPORA APPROXIMATA James.

*Helopora approximata* JAMES, Paleontologist, No. 1, 1875, p. 3.

*Original description.*—"Associated with this species [*Helopora parvula*] are cylindrical examples with one or two more rows of cells, and *bulbous* upper terminations; the bulbs carry very small pores, which are not on other parts of the fossil; in other features they do not seem to differ from *H. parvula*. Should these prove, on further investigation, to be distinct, I propose the name *Helopora approximata*."

The writer has failed to find specimens having the characters mentioned above either on the slabs containing the types of *Helopora parvula* or in the rest of the collection. However, specimens of small species of *Bythopora* are often found showing a bulbous extremity as described by James, and undoubtedly he had some of these before him. This bulbous extremity is probably due to abortive growth following some injury and since it is occupied solely by small cells may be regarded as analogous to the expanded base of the zoarium.

*Helopora approximata* is probably a synonym of the common *Utica* form, *Bythopora arctipora* (Nicholson), but in the absence of the types or other specimens bearing this name it is impossible to decide the

point satisfactorily. Besides, James may or might have included several or indeed all of the small species of *Bythopora* (*B. arctipora*, *parvula*, *dendrina*, *striata* and *delicatula*) under his name. For these and other obvious reasons the name should have no standing.

**HELOPORA HARRISI (James) Ulrich.**

Plate VII, fig. 8.

*Helopora harrisi* JAMES, Paleontologist, No. 7, 1883, p. 58, pl. II, figs. 2-2b.

*Helopora harrisi* ULRICH, Geol. and Nat. Hist. Surv. Minnesota, Final Rep., III, Pt. 1, 1893, p. 195, pl. III, figs. 11b, 11c, 12.

The description and figures of this characteristic and abundant Richmond species given by Mr. James are incorrect in so many details that it is doubtful if the form could be recognized from his work. The published knowledge of the species really dates from Ulrich's work in 1893, when this author gave a good description and figures which accurately represent the form. It is unnecessary to mention the incorrect details of James's description and figures, since a comparison with Ulrich's work, which is known to be correct by comparison with his types, will bring out the errors of the former.

*Occurrence.*—This species is a characteristic fossil of the Waynesville formation of the Richmond group, the type specimens of both James and Ulrich coming from Waynesville, Ohio. Often when the clay above the limestone layers bearing the species is washed, free joints of the dismembered zoaria are found literally by the million.

**HEMIPHFRAGMA WHITFIELDI (James).**

Plate II, figs. 15, 16; plate IV, figs. 1-4; plate V, fig. 5.

*Chonetes barrandi* ? (NICHOLSON) JAMES, Catal. Foss. Cincinnati Group, 1875, p. 4.

*Monticulipora* (*Chonetes*) *whitfieldi* JAMES, Paleontologist, No. 5, 1881, p. 34.

*Monticulipora whitfieldi* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 178.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 200.

*Hemiphragma whitfieldi* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 286.

All of the previous descriptions of this fine species fail to reveal its chief characteristic, namely, the presence of semidiaphragms in the peripheral region. These structures occur in the original types and may be readily observed in all thin sections, both vertical and tangential. These incomplete partitions may also be seen on well preserved, clean specimens with the aid of a hand lens. Vertical fractures when moistened and examined with a glass likewise show these partitions very clearly.

The species is found generally in abundance wherever the lower and middle divisions of the Eden shale are exposed in the vicinity of Cincinnati. The zoarium of the form found in the lower division, from which James's types of the species were derived, is of rounded, fre-

quently dividing stems commonly varying between 4 and 8 mm. in diameter. The middle Eden form, however, is more robust, the branches being subcylindrical or compressed and usually over 10 mm. in width. In all other respects the two forms are alike.

Surface smooth, with maculae composed of zoecia larger and mesopores more numerous than in the intervening spaces. Zoecia large, rather thin-walled, polygonal, 5 of the normal size in 2 mm. Mesopores angular, few among the ordinary zoecia, more numerous in the maculae. Acanthopores seemingly absent and, if developed at all, small and inconspicuous.

In internal structure the most marked feature is the presence of semi-diaphragms in the peripheral region of the zoecial tubes. Besides these, vertical sections as well as vertical fractures show the zoecial walls in the axial region to be strongly crinkled. The zoecial tubes in this region are almost entirely without diaphragms. The mesopores which develop in the peripheral region only, are crossed by the usual straight complete tabulae. Tangential sections show thin-walled polygonal zoecia, few mesopores and apparent absence of acanthopores, but bring out especially the dark line separating adjoining zoecia.

*H. whitfieldi* is closely related to and is probably a descendant of the Trenton species *Hemiphragma tenuimurale* Ulrich,<sup>a</sup> but the more robust growth and several internal features, particularly the crinkled walls, of the species under consideration will suffice in distinguishing the two. Of associated bryozoa none approaches *H. whitfieldi* closely enough to require comparison.

*Occurrence.*—Abundant and characteristic of the lower (Economy) and middle (Southgate) divisions of the Eden shale at Cincinnati, Ohio, and vicinity.

#### HOMOTRYPA WORTHENI (James).

*Monticulipora (Monotrypa) wortheni* JAMES, Paleontologist, No. 6, 1882, p. 50; No. 7, 1883, pl. i, fig. 2.

*Monticulipora wortheni* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 184, pl. II, figs. 3a, b.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 207.

*Homotrypa wortheni* BASSLER, Proc. U. S. Nat. Mus., XXVI, 1903, p. 583, pl. XXIV, figs. 10-14.

Both the internal and external features of this species were described and illustrated by the writer in 1903,<sup>b</sup> this conception of the species being based upon specimens in the collection of the U. S. National Museum with Mr. James's labels attached. A comparison of these specimens with the types shows that all are of the same species.

*H. wortheni* is a characteristic fossil of the Whitewater member of

<sup>a</sup> Ulrich, Geol. Nat. Hist. Surv. Minn., Final Rep., III, Pt. 1, 1893, p. 301, pl. xxiv, figs. 20-23.

<sup>b</sup> Proc. U. S. Nat. Mus., XXVI, 1903, p. 583.

the Richmond group and is found generally in abundance wherever these strata are exposed. The species may be distinguished from associated bryozoa by its sharply tuberculated branches, while vertical fractures examined under a hand lens will show the cystiphragms in the peripheral region of the tubes and other features characterizing *Homotrypa*.

*Occurrence*.—Richmond group, Whitewater member. The types are from Lynchburg, Ohio, but the species is abundant at many localities in Ohio and Indiana and notably so at Richmond, Indiana, and vicinity.

#### LEPTOTRYPA CLAVACOIDEA (James).

*Chaetetes clavacoidens* JAMES, Catal. Lower Sil. Foss., 1871, p. 1 (named only);

Catal. Foss. Cincinnati group, 1875, p. 1.

*Monticulipora* (*Monotrypa*) *clavacoidea* NICHOLSON, Genus *Monticulipora*, 1881, p. 182, fig. 37.

*Leptotrypa clavacoidea* ULRICH, Jour. Cincinnati Soc. Nat. Hist., VI, 1883, p. 159.

*Monticulipora clavacoidea* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 25.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 84.

The club-shaped zoarium and the absence of mesopores cause the recognition of this species to be comparatively easy. James gave a brief description in 1875, but the knowledge of the species is really based on Nicholson's full description and figures published in 1881.

*Occurrence*.—An abundant and characteristic fossil of the Corryville member, McMillan formation, Cincinnati and vicinity.

#### LIOCLEMELLA SUBFUSIFORMIS (James).

Plate VII, figs. 4-7.

*Monticulipora* (?*Monotrypa*) *subfusiformis* JAMES, Paleontologist, No. 6, 1882, p. 52; No. 7, 1883, pl. 1, fig. 1.

*Monticulipora fusiformis* (not WHITFIELD sp.) JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 26.—J. F. JAMES, Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 83.

*Lioclemella subfusiformis* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 308.

James and James in 1888<sup>a</sup> regarded this species as synonymous with Whitfield's *Monticulipora fusiformis*,<sup>b</sup> but a comparison of specimens of the latter with the types of *M. subfusiformis* shows that Whitfield's species has a much larger zoarium, conspicuous and numerous acanthopores, more rounded zoecia, and many more mesopores.

Zoarium small, generally less than 13 mm. in length, club shaped, pointed at the lower end probably for articulation with a basal expansion, expanding slightly toward the upper portion. Surface smooth, maculae inconspicuous. Zoecia small, 10-12 in 2 mm., angular, thin-walled, sometimes in contact but generally separated by thin-walled,

<sup>a</sup> Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 83.

<sup>b</sup> Ann. Rep. Geol. Surv. Wisconsin for 1877, 1878, p. 70.

angular mesopores. The latter often attain the size of the zoecia and, especially in thin sections, may be mistaken for them. However, a glance at the tabulation shown in vertical sections will distinguish the two, the mesopores being closely tabulated and the zoecia having no diaphragms at all. In tangential sections the outer side of the walls of the zoecia are always more or less convex, while the sides of the mesopores are correspondingly concave. Acanthopores small and usually inconspicuous both at the surface and in sections.

The small, unbranched, club-shaped zoarium with thin-walled polygonal zoecia separated by more or less numerous mesopores, causes the separation of this species from associated bryozoa to be quite easy. Comparison with the related form *L. fusiformis* from the Richmond group of Wisconsin is given above.

*Occurrence*.—Quite abundant in the Waynesville formation of the Richmond at a number of localities in Ohio and Indiana. The James types were found at Westboro, Ohio.

**MONOTRYPA UNDULATA var. HEMISPHERICA (J. F. James).**

*Monticulipora* (*Monotrypa*) *undulata* (part) NICHOLSON, Genus *Monticulipora*, 1881, p. 170, fig. 33a-c.

*Monticulipora undulata* var. *hemispherica* J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XV, 1893, p. 157, figs. 10a-c.

*Monotrypa undulata-hemispherica* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 317.

This variety is founded upon Nicholson's description and figures<sup>a</sup> of what he regarded as a "rounded or irregularly sphaeroidal" form of his *Monotrypa undulata*. There are no specimens of this variety in the James collection, nor is it known that either the species or variety occur in the vicinity of Cincinnati. If James's subordinate name, which is a misnomer, the form being subglobular and not hemispheric, is to be recognized, it must rest upon the Canadian types in Nicholson's collection. Until these or other authentic examples are again studied, the status of the name can not be definitely determined. It may be remarked, however, that this supposed subglobular variety of *M. undulata* must be very near, if indeed not identical, with Ulrich's *M. subglobosa*.

*Occurrence*.—Nicholson's specimens are said to come from the Hudson River group in Ontario, Canada.

**MONTICULIPORA CINCINNATIENSIS (James).**

*Chaetetes cincinnatiensis* JAMES, Catal. Sil. Foss., Cincinnati group, 1875, p. 2.

*Monticulipora cincinnatiensis* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 170.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 188.

*Monticulipora* (*Peronopora*) *cincinnatiensis* NICHOLSON, Genus *Monticulipora*, 1881, p. 226, pl. II, figs. 6-6c.

<sup>a</sup>Genus *Monticulipora*, 1881, p. 170.

Although Mr. James gave a fair definition of this species in the Catalogue,<sup>a</sup> our knowledge of the form really dates from Nicholson's work in 1881.

The species is a rather abundant and characteristic fossil of the Corryville member, and may be distinguished from other forms of the genus by its loosely incrusting habit of growth, strong and closely set monticules, and numerous mesopores. Its internal characters are those of a typical *Monticulipora*, cystiphragms occurring in both the immature and mature regions, while the walls have the peculiar granulose structure characterizing that genus.

*Occurrence.*—Corryville member, McMillan formation, Cincinnati, Ohio, and vicinity.

#### MONTICULIPORA CLEAVELANDI James.

*Monticulipora* (*Heterotrypa*?) *cleavelandi* JAMES, Paleontologist, No. 6, 1882, p. 49, pl. 1, fig. 7.

*Monticulipora cleavelandi* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 15, pl. 1, fig. 4.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 68.

*Monticulipora cleavelandi* ULRICH and BASSLER, Smithsonian Misc. Coll. (Quart. issue), XLVII, 1904, p. 16, pl. vi, figs. 4-6.

This is one of the most easily recognized bryozoa of the Cincinnati rocks, inasmuch as it is the only ramose species of *Monticulipora* so far known from these strata. A vertical fracture when examined under the hand lens will show the presence of cystiphragms in both the axial and peripheral regions, thus indicating its generic position under *Monticulipora*. The specific characters are particularly the ramose habit of growth and the absence of mesopores.

Ulrich and the writer<sup>b</sup> have recently redefined this species and given figures of the internal structure. None of the James descriptions are adequate for the recognition of the species, inasmuch as the method of growth and internal characters attributed to it by them do not agree with the specimen marked as the type. This reason would doubtless have justified the rejection of the name, but as the species had not been described in the meantime it was deemed advisable to establish it under the same name proposed for it by James.

*Occurrence.*—Very abundant at several localities in Clinton County, Ohio, where the Whitewater formation of the Richmond group is exposed. James's type is from a locality near Lynchburg, Highland County, Ohio.

<sup>a</sup> Catal. Sil. Foss., Cincinnati group, 1875, p. 2.

<sup>b</sup> Smithsonian Misc. Coll., XLVII, 1904, p. 16.

**MONTICULIPORA CLINTONENSIS James.**

*Monticulipora (Heterotrypa) clintonensis* JAMES, Paleontologist, No. 6, 1882, p. 45, pl. 1, fig. 9.

*Monticulipora clintonensis* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 20, pl. 1, figs. 1, 1a.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 73.

The types of this form are missing, and unless they are found at some later date it will be impossible to determine its exact status. However, the description of *M. clintonensis* leads the writer to believe that Mr. James had before him specimens of the species described by Ulrich in 1879 as *Atactopora subramosa*,<sup>a</sup> now referred to the genus *Heterotrypa*. This belief is strengthened by the fact that a specimen in the collection of the U. S. National Museum labelled by Mr. James as *M. clintonensis* is a typical example of *Heterotrypa subramosa*.

*Occurrence*.—James's types were recorded from the upper part of the Cincinnati rocks (Richmond) in Clinton County, Ohio. *Heterotrypa subramosa* is a common and characteristic fossil in the Richmond group of Ohio, Indiana, and Kentucky.

**MONTICULIPORA HOSPITALIS NEGLECTA James and James.**

*Monticulipora hospitalis* var. *neglecta* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 27, pl. 1, fig. 3.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1896, p. 124.

Neither the type nor any other specimen of this variety could be found in the collection, and therefore unless the type turns up later the status of the above name can not be determined. The authors in separating the variety from *M.* (now *Prasopora*) *hospitalis* say that "variety *neglecta* differs mainly in possessing conspicuous monticules." If this is the only point of difference exhibited by the type specimen, var. *neglecta* is a synonym for the species itself since in the genus *Prasopora*, as in many other monticuliporoid genera, the monticules show a considerable variation in the same species. It is thought probable that the type specimen will show that it is not at all related to *Prasopora hospitalis*, but until the figured specimen is found the name might as well be dropped. Judging from James and James's figure, it seems not unlikely that the original may belong to *Monticulipora consimilis* described by Ulrich in 1882.

**MONTICULIPORA PAPILLATA James and James.**

*Monticulipora papillata* JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 23.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 81 (not *Nebulipora papillata* McCoy).

The specimens from the Cincinnati rocks, supposed by James and James to be identical with the English species *Nebulipora papillata*

<sup>a</sup>Jour. Cincinnati Soc. Nat. Hist., II, 1879, p. 124, pl. XII, figs. 6-8c.

McCoy can not now be located in the collection. The matter is of no consequence, however, since a fragment of McCoy's type specimen, now in the collection of the U. S. National Museum, does not agree with any of the Cincinnati bryozoa, and there is thus little doubt that James and James were in error.

**PALESCHARA BEANI (James).**

*Ceramopora ? beani* JAMES, Paleontologist, No. 1, 1878, p. 5.

*Ceramopora ? beani* JAMES, Jour. Cincinnati Soc. Nat. Hist., VII, 1884, p. 23, fig. 3-3b.—JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI, 1888, p. 37.

*Paleschara beani* ULRICH, American Geologist, I, 1888, p. 186.

This fine species was so defined and figured by James in 1884 that its recognition is a matter of no difficulty. The very important feature of the species was, however, not mentioned, namely, that unlike all other similar Ordovician bryozoa, maculae are absent. Though the zoecia radiate from one or more initial points, the surface of the zoarium presents no indication of the clusters of larger zoecia or of mesopores that invariably mark the surface of otherwise similar Paleozoic bryozoa. In this peculiarity, as well as in all other features, the species in question is in accord with *Paleschara*. As remarked by James, *P. beani* seems constantly to incrust the shells of *Orthoceras duseri*, the most abundant cephalopod in the beds containing it. Indeed, this association of the bryozoan and cephalopod is so common that Hall and Whitfield<sup>a</sup> seem to have figured *P. beani* as the surface ornamentation of *Orthoceras duseri*.

*Occurrence*.—Not uncommon in the Waynesville formation of the Richmond group in Ohio and Indiana. In the original description James erroneously cites the species from Cincinnati.

**PHÆNOPORA EXPANSA Hall and Whitfield.**

*Phænopora (Ptilodictya) expansa* HALL and WHITFIELD, Geol. Surv. Ohio, Pal., II, 1875, p. 114, pl. v, fig. 1.

*Phænopora expansa* FOERSTE, Geol. Surv. Ohio, VII, 1895, p. 598, pl. xxix, fig. 1.

*Ptilodictya platyphylla* JAMES, Paleontologist, No. 3, 1879, p. 21.

*Phænopora platyphylla* WELLER, Geol. Surv. New Jersey, Rept. on Pal., III, 1903, pl. xix, figs. 5-7.

The type of James's *Ptilodictya platyphylla* has recently been figured by Professor Weller,<sup>b</sup> whose figures led the writer to suspect that the species was a synonym for *Phænopora expansa* Hall and Whitfield. An examination of the types themselves changed the suspicion to a certainty.

<sup>a</sup> Geol. Surv. Ohio, Pal., II, 1875, p. 97, pl. iii, fig. 4.

<sup>b</sup> Geol. Surv. of New Jersey, Report on Pal., III, 1903.

James gave a good definition of his species with the exception that he omitted stating the generic character—the presence of the two mesopores between the ends of the zoecia.

*Phænopora expansa* is distinguished from associated bryozoa by its broad bifoliate fronds springing from a pointed base, with oval zoecia arranged in parallel rows and with the ends of the zoecial apertures separated by two mesopores. The species is distinguished from other species of *Phænopora* by the broad, unbranched monticulated zoarium, and by the size of the zoecia (6.5 in 2 mm. measuring lengthwise, and 8.5 in the same space transversely).

*Occurrence*.—James's types were found in the Clinton of Clinton County, Ohio, while those of Hall and Whitfield came from the corresponding strata at Dayton, Ohio.

#### PHÆNOPORA FIMBRIATA (James).

Plate VII, figs. 11, 12.

*Ptilodictya fimbriata* JAMES, Paleontologist, No. 1, 1878, p. 8.

*Phænopora fimbriata* FOERSTE, Bull. Sci. Lab. Denison Univ., II, 1887, p. 161; III, 1888, pl. xv, fig. 7.

*Phænopora fimbriata* FOERSTE, Geol. Surv. Ohio, VII, 1895, p. 599, pl. xxviii, fig. 7.

*Siccupora ruckerii* HALL, Twelfth Ann. Rept. Indiana Geol. Nat. Hist., 1883, p. 268, pl. xiii, figs. 1, 2.

Zoarium of narrow, parallel margined, smooth, compressed, bifoliate branches averaging 3.5 mm. in width, and forming by frequent bifurcation a flexuous frond, which in the type specimen is about 50 mm. in height and 60 mm. wide. Margins of branches rather wide and occupied by several rows of pores similar to the mesopores placed between the ends of the zoecial apertures. These marginal pores give to the edges of the branches the very finely striated appearance mentioned by James as the marked feature of the species. However, the number of pores along the margin can not be considered a good specific character, as it depends upon the age of the zoarium, young examples exhibiting few, and the oldest specimens the maximum number. The zoecial apertures are elliptical and arranged in longitudinal rows; 5 zoecia in 2 mm. measuring lengthwise, and nine rows in the same space transversely. Two pits or mesopores usually separate the ends of the zoecia, but occasionally three may be detected.

This fine, characteristic Clinton species is distinguished from the other branching forms of *Phænopora* by its narrow, flexuous, dichotomously dividing branches and the general aspect of the resulting zoarium.

*Occurrence*.—The type is from the Clinton formation in Clinton County, Ohio. Other localities are Dayton and Belfast, Ohio.

## PRASOPORA FALESI (James).

Plate I, figs. 1-4.

*Monticulipora falesi* JAMES, Jour. Cincinnati Soc. Nat. Hist., VII, 1884, p. 138, pl. VII, figs. 2-2d.—JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., X, 1888, p. 168.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVI, 1894, p. 185.

The character relied upon by the author for distinguishing this species was the presence of a conical, sharp-pointed groove extending across the under surface. Any student of the bryozoa knows, or ought to know, that the shape of the excavation left by the object upon which zoarial growth commenced, is certainly not a specific character. The same species may select indiscriminately any foreign object such as a mollusk, brachiopod, or another bryozoan to commence its zoarial growth. The specimens distinguished by James as *M. falesi* selected some conical shell such as *Hyolithes* or the tapering end of a cephalopod, the impressions left of the shell after its removal not permitting of accurate determination. An examination of the types—the three specimens figured in 1884—shows that two distinct species are represented. Inasmuch as one of these is new, James's specific name is here adopted for this form. The original of fig. 2 of the article cited above (1884) is a small but typical specimen of *Prasopora simulatrix* Ulrich,<sup>a</sup> while figs. 2a-2d represent young examples of a species differing from *P. simulatrix*, notably in having acanthopores and smaller zoecia.

Comparing *P. falesi* and *P. simulatrix* the following differences are noted. In growth the latter rises into dome-shaped or petasiform masses usually 40 or 50 mm. in diameter, and with a concave base lined by a concentrically wrinkled epitheca, while mature specimens of the former are rounded or irregularly hemispherical in shape, seldom over 20 mm. in diameter, and do not show such a well-marked epitheca. *P. simulatrix* has about 7 of the ordinary zoecia in 2 mm., while *P. falesi* shows 8 to 8½ in the same space. Vertical sections bring out especially the small acanthopores of *P. falesi*, but in *P. simulatrix* these structures are absent. The tabulation and number and distribution of the mesopores is much alike in the two species, but the difference in growth, size of zoecia, and the development of acanthopores in one, makes their separation comparatively easy.

*Occurrence.*—Very abundant in the Lexington limestone of the Trenton, in the vicinity of Danville, Kentucky. James records the horizon as about that of the tops of the hills at Cincinnati, but this is undoubtedly an error, as his type specimens correspond exactly with other examples of the species found in the Trenton at Danville.

<sup>a</sup> Fourteenth Ann. Rep. Geol. and Nat. Hist. Surv. Minnesota, 1886, p. 85.

**PRASOPORA HOSPITALIS (Nicholson).**

Plate VII, figs. 1-3.

*Monticulipora* (*Prasopora*) *selwynii* var. *hospitalis* NICHOLSON, Genus *Monticulipora*, 1881, p. 209, fig. 45.*Monticulipora* (*Heterotrypa*) *winchelli* JAMES, Paleontologist, No. 6, 1882, p. 48; No. 7, 1883, pl. I, fig. 5.*Monticulipora winchelli* J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 87.

An example of the type specimen figured by James shows that *Monticulipora* (*Heterotrypa*) *winchelli* is the same as the common Richmond form, *Prasopora hospitalis* (Nicholson). In the original description James compares his species with Nicholson's, but states that the internal structure is very different. The tabulation of the zoecia as shown in the slide studied by James (see Plate VII, fig. 1) does appear different from that found in *P. hospitalis*, but this appearance is largely due to an error in the preparation of the thin section. The zoecial tubes of *P. hospitalis*, when properly sectioned are always lined by cystiphragms. In James's section of *P. winchelli*, however, although it exhibits all the other characters of *P. hospitalis*, the tabulation appears as though not including true cystiphragms but to consist entirely of merely more or less curved diaphragms. The originally sectioned specimen, as proved by a section prepared by the writer, contains an abundance of true cystiphragms, and thus is shown to be a normal example of *P. hospitalis* in every respect. That James's section appears to show a different type of tabulation is believed to result from the fact that it divided the zoarium in a direction parallel with, instead of at right angles to, its growing edge. On reflection it is apparent that species such as this in which the zoecia radiate from the center toward the growing edge will exhibit their normal internal characters best in vertical sections taken along such a radius; or, in other words, at right angles to the growing edge. Thus the cystiphragms of a species will generally appear as nearly straight or more or less curved diaphragms in a section cutting them in a direction opposite to their radial arrangement. Furthermore, it is a fact that James's section was taken from the thin outer edge of the zoarium and therefore exhibits only an immature condition of the zoecial tubes. In nearly all *Monticuliporidae* the cystiphragms in the basal part of the zoarium are much larger and extend much farther toward the opposite side of the tube than they do in later stages of growth. Hence, in an improperly prepared vertical section of the immature region, the appearance presented by the cystiphragms is likely to be, as in James's section, that of merely curved diaphragms.

The massive growth, numerous and closely tabulated mesopores, strong acanthopores, and rounded zoecia with both cystiphragms and

diaphragms abundantly developed, distinguish *Prasopora hospitalis* from associated bryozoa, while the numerous and strong acanthopores serve to separate it from other species of the genus.

*Occurrence*.—Abundant throughout the Richmond group at most localities in the Ohio Basin. The type of *M. winchelli* was found near Lynchburg, Highland County, Ohio.

#### PROBOSCINA FRONDOSA (Nicholson).

*Aulopora frondosa* JAMES, Additions to Catal. Foss. Cincinnati Group, 1873, p. 15 (named only).

*Alecto frondosa* NICHOLSON, Geol. Surv. Ohio, Pal., II, 1875, p. 266, pl. xxv, figs. 3–3b.

*Proboscina frondosa* ULRICH, Geol. and Nat. Hist. Surv. Minnesota, Final Rep., III, Pt. 1, 1893, p. 119, pl. 1, fig. 28.

The name *Aulopora frondosa* is a *nomen nudum*, since James never defined the species. Nicholson gives a satisfactory description and good figures of the species and credits the name to James. An excellent figure is given by Ulrich in the work cited above.

*Occurrence*.—The typical form is not uncommon in the Corryville member of the McMillan formation at Cincinnati and vicinity.

#### PTILODICTYA NODOSA James.

*Ptilodictya nodosa* JAMES, Paleontologist, No. 3, 1879, p. 20.

*Ptilodictya nodosa* ULRICH, Jour. Cincinnati Soc. Nat. Hist., IV, 1882, pl. vii, figs. 2, 2a.

*Ptilodictya variabilis* ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 304, figs. 2a and 6b.

*Ptilodictya clintonensis* JAMES, Paleontologist, No. 5, 1881, p. 38.

*Ptilodictya teres* JAMES, Paleontologist, No. 5, 1881, p. 40.

As suggested by Ulrich's name, *P. variabilis*, this is quite a variable species, the shape of the zoarium ranging from smooth, narrow, sword-shaped examples scarcely 2 mm. in width to broader nodose fronds reaching a width of 10 mm. or more. James's type specimen of *P. nodosa*, an old and strongly marked specimen, was figured by Ulrich in 1882. This author in 1890 proposed the new name *Ptilodictya variabilis* for the species on the ground that *P. nodosa* was preoccupied by Hall's *Escharopora recta* var. *nodosa*, a New York Trenton form. At that time *Escharopora* and *Ptilodictya* were supposed to represent the same generic type, but since Ulrich's careful work in 1893 we know these two genera to be distinct. Hall's species and variety being the typical forms of *Escharopora*, *Ptilodictya nodosa* is not preoccupied and may therefore stand as a valid name.

This species is distinguished from the associated forms of *Ptilodictya* by its straight, parallel-edged frond. Young specimens have a smooth surface, but after the zoarium attains a width of 3 mm. or more the maculae develops as strong nodes arranged in more or less

parallel longitudinal series. The internal structure is essentially the same as that figured by Ulrich for *P. magnifica* Miller and Dyer.<sup>a</sup>

The types of *Ptilodictya clintonensis* are straight, parallel-edged, smooth, unbranched fronds less than 3 mm. in width, and agree in all respects with numerous other examples regarded as young zoaria of *P. nodosa*.

*Ptilodictya teres* was distinguished by its author mainly because the zoarium in the specimen described bears "six or seven rows of oval pores, on the upper part, arranged in an alternating manner between exceedingly delicate raised lines." The general shape and a thin section of the type indicate that *P. teres* also is a synonym of *P. nodosa*, being merely an unusual or perhaps abortive example of that species. The oval pores mentioned by James are of zoecia, the zoecial apertures being of this shape and arranged between raised lines on the striated basal parts of all ptilodictyoid bryozoa.

*Occurrence*.—Whitewater formation of the Richmond group. The types of *P. nodosa*, and also of its two synonyms, came from Clinton County, Ohio, where the species seems more abundant than elsewhere.

#### PTILODICTYA PLUMARIA James.

*Ptilodictya plumaria* JAMES, Paleontologist, No. 1, 1878, p. 4.

*Ptilodictya plumaria* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, pl. vii, figs. 1, 1a.

This species resembles the preceding *P. nodosa* in its general zoecial and surface characters, but differs in this that, instead of being sword-shaped, the zoarium expands rapidly from the pointed striated base into a leaf-like frond sometimes exceeding 25 mm. in diameter. A typical specimen of the species was figured by Ulrich.<sup>b</sup>

The three Richmond species of *Ptilodictya*, *P. nodosa*, *P. plumaria*, and *P. magnifica* Miller and Dyer, form a series, the first comprising long, rather narrow, parallel-edged fronds, the third forming broad and rather irregular expansions, while the second is intermediate in its zoarial shape. A similar relationship is exhibited by the three Fairview species of *Escharopora*, *E. fulciformis*, *E. maculata*, and *E. pavonia*. In both of these groups of bryozoa the shape of the zoarium is within reasonable limits, fairly constant, and affords a ready means of distinguishing the species.

*Occurrence*.—James's type is from Warren County, Ohio, but the species occurs at a number of localities in southwestern Ohio and southeastern Indiana, where the Whitewater formation of the Richmond, to which beds these three forms of *Ptilodictya* are restricted, are exposed.

<sup>a</sup> Geol. Surv. Illinois, VIII, 1890, p. 391, figs. 11a-c.

<sup>b</sup> Jour. Cincinnati Soc. Nat. Hist., V, 1882, pl. vii, figs. 1, 1a.

**PTILODICTYA WELSHI James.**

*Ptilodictya* sp. (?) JAMES, Paleontologist, No. 1, 1878, p. 8 (name *Ptilodictya welshi* suggested).

Under the caption of *Ptilodictya* sp. ? James described a Clinton bifoliate bryozoan and suggested if it prove to be a distinct species that the name *Ptilodictya welshi* be applied to it. The type is either lost or never formed a part of the James collection, but, judging from the description, *P. welshi* is almost certainly the same species as that named and figured by Van Cleve as *Eschara multifida* in 1853 on the plates of fossils which he distributed about that time. Van Cleve's figure excellently represents his species, which was later described by Hall<sup>a</sup> and is now referred to the genus *Phænopora*. If James's species should prove to be the same, it ought to be considered a synonym for Van Cleve's name since both appear in equally obscure publications and the earlier figure of the one is of more service in recognizing the form than the description of the other.

*Occurrence*.—Clinton formation, Clinton County, Ohio.

**RHINIDICTYA PARALLELA (James).**

Plate II, figs. 5-7; plate V, figs. 2, 3.

*Ptilodictya parallela* JAMES, Paleontologist, No. 1, 1878, p. 5.

*Rhinidictya parallela* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 170.

*Ptilodictya granulosa* JAMES, Paleontologist, No. 1, 1878, p. 4.

Original description of *Ptilodictya parallela*: "Polyzoary, a flattened, linear, unbranched, two-edged frond, about one line wide, longest example observed about one inch. Surface gently convex, celluliferous on both faces; edges very thin and sharp. Eight or ten alternating rows of elliptical cells arranged between longitudinal lines; one row on each edge having an oblique direction. Cell apertures not raised, five or six in the space of a line measuring longitudinally."

Numerous intermediate specimens in the U. S. National Museum prove beyond any question that the types of *Ptilodictya parallela* and *P. granulosa* are founded upon different stages of growth of one and the same species, the type of the latter representing merely the more mature or aged stage in which numerous granules develop. The definition of *P. granulosa* precedes that of *P. parallela* in the Paleontologist, but the parallel-edged branches are so marked a character in this species that the specific name calling attention to this fact is retained. All species of *Rhinidictya* have a *granulosa* stage, so that this name is without any special significance.

The straight, parallel-edged, seldom branching, bifoliate zoarium, with the zoecia arranged in longitudinal rows, is so different from associated bryozoa that no difficulty is experienced in recognizing the

<sup>a</sup>Twelfth Ann. Rep. Indiana Geol. Nat. Hist., 1883, p. 268, pl. xiv, fig. 4.

species. The associated ptilodictyoids, with the exception of *Stictoporella flexuosa*, may be distinguished at sight by their jointed zoaria, the articulation being at the base alone as in *Escharopora* or at numerous points as in *Arthropora*. The mesopores of *S. flexuosa* will readily separate it from *R. parallela*.

*Occurrence*.—Lower beds of the Eden shale at Cincinnati, Ohio, and vicinity.

#### RHINOPORA VERRUCOSA Hall.

*Rhinopora verrucosa* HALL, Nat. Hist. New York, Pal., II, 1852, p. 48, pl. xix, fig. 1a-c.

*Escharina ? distorta* JAMES, Paleontologist, No. 3, 1875, p. 21.

The types of *Escharina ? distorta* show that this name is founded upon specimens of the characteristic Clinton bryozoan *Rhinopora verrucosa*. The specimens are embedded in solid limestone and show only their epithecal side. In breaking the rock, the two leaves of the bifoliate fronds of *Rhinopora* part along the smooth median plane because the poriferous side of each leaf is rougher, and therefore adheres to the rock. By means of thin sections, however, the identity of these fronds with *Rhinopora verrucosa* was proved beyond a doubt.

*Occurrence*.—The types of James's species were from the Clinton, near Wilmington, Clinton County, Ohio. *R. verrucosa* is found generally in abundance at most localities in the New York and Ohio areas of Clinton shale.

#### SAGENELLA STRIATA James.

*Sagenella striata* JAMES, Paleontologist, No. 3, 1879, p. 22.

The type specimens described under this name by Mr. James are two small thin expansions parasitic upon bryozoa from the Eden shale. The surface of these expansions is ornamented with long, fine striae radiating from a similarly striated crater-like central area. A careful examination of this surface with a lens, or, better still, of the structure of the specimens by means of thin sections under the microscope, shows that the striae are the greatly elongated and generally confluent zoecial apertures of bryozoa with the wall structure characteristic of the genus *Escharopora*. One can now infer from their general shape and structure that the crater-like depressions of these striated parasitic growths are the basal sockets with which the pointed end of the zoaria of *Escharopora* articulated. That this inference is correct is proved by the occasional discovery of a zoarium with its point in place in the basal socket or in such close proximity that their relation to each other can not be doubted. It is also a fact that wherever these attached expansions occur, the erect fronds of one or other of the species of *Escharopora* may always be found.

By themselves these basal sockets show no specific differences, and the species to which any particular specimen belongs must be deter-

mined by the horizon in which it occurs. Naturally when several species of *Escharopora* occur at the same horizon, the determination of their respective basal sockets becomes very difficult if not impossible unless the pointed zoarium and parasitic base are still in position. There can be little doubt that *Sagenella striata* is the articulating basal expansion of *Escharopora acuminata* (James), since the latter is the only species of *Escharopora* known in the same beds of the Eden shale.

Depending upon James's statement<sup>a</sup> that his specimens were collected "at the horizon of the hilltops at Cincinnati," Nickles and the writer, in the cross references in their Synopsis of American Fossil Bryozoa, referred *Sagenella striata* to the Fairview species *Escharopora falciformis*. However, this reference and remarks concerning the organism were inadvertently omitted under the synonymy of the latter. The articulating bases of *E. falciformis* were described by Ulrich under the names *Crateripora lineata* and var. *expansa*<sup>b</sup> before their true relations, as published by him in 1882,<sup>c</sup> were ascertained.

#### STICTOPORELLA FLEXUOSA James.

*Ptilodictya flexuosa* JAMES, Paleontologist, No. 1, 1878, p. 4.

*Stictoporella flexuosa* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 169.

*Stictoporella interstincta* ULRICH, Jour. Cincinnati Soc. Nat. Hist., V, 1882, p. 169, pl. VIII, figs. 9, 9a.

*Stictoporella interstincta* ULRICH, Geol. Surv. Illinois, VIII, 1890, p. 394, fig. 14a, b.

For the identification of this species the student is referred to the description and figures of the external characters given by Ulrich in 1882, and the figures of the internal features published by the same author in 1890. Ulrich described the form as *Stictoporella interstincta*, believing that *Ptilodictya flexuosa* James was a distinct species of *Stictoporella*. More recent study, however, has shown that both names are founded upon unimportant mutations of the same species.

*S. flexuosa* is easily recognized by its narrow, generally parallel-edged, bifoliate branches bearing rather large elliptical, flaring zoecial apertures, with their ends separated always by two but sometimes by three or four elongate interstitial cells.

*Occurrence*.—Not uncommon in the Economy member of the Eden shales in the vicinity of Cincinnati, Ohio.

#### STIGMATELLA DYCHEI (James).

Plate III, figs. 8–10.

*Monticulipora (Monotrypa) dychei* JAMES, Paleontologist, No. 6, 1882, p. 52.

*Monticulipora dychei* JAMES, Jour. Cincinnati Soc. Nat. Hist., VI, 1883, p. 235, pl. x, figs. 2–2e.—JAMES and JAMES, Jour. Cincinnati Soc. Nat. Hist., XI,

1888, p. 25.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XVIII, 1895, p. 83.

<sup>a</sup>Paleontologist, No. 3, 1875, p. 21.

<sup>b</sup>Jour. Cincinnati Soc. Nat. Hist., II, 1879, p. 30.

<sup>c</sup>Idem, V, 1882, p. 151.

*Leptotrypa ? dychei* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, p. 298.  
*Stigmatella dychei* ULRICH and BASSLER, Smithsonian Misc. Coll. (Quart. Issue),  
 XLVII, 1904, pl. x, fig. 11.

Both the internal and external features of this species have been figured by its author satisfactorily enough for its recognition, and additional illustrations of the internal structure are given here only to bring out points not mentioned by James nor shown in his figures.

The zoarium is an expansion loosely incrusting crinoid columns and sometimes attains considerable size, the type specimen being about 180 mm. in length and varying from a minimum diameter of 5 mm. at the ends to a maximum of 60 mm.

In vertical sections the noticeable features are the almost complete absence of diaphragms and the development of the acanthopores in zones, the latter feature in combination with the former being the principal characteristic of the genus *Stigmatella*. Tangential sections passing through one of these zones of acanthopores exhibit these structures of a fair size at the zoecial angles, but a section through any other part of the zoarium shows thinner-walled zoecia with the acanthopores either very small or not present at all.

The loosely incrusting method of growth, thin-walled angular zoecia with mesopores practically wanting, the development of acanthopores in zones and the almost entire absence of diaphragms are characters causing this species to be easily recognized. *S. clavis* (Ulrich), a common and highly characteristic fossil of the Eden shales, also grows on crinoid columns, but it can not be confused with *S. dychei*, its zoaria being much smaller and the surface nearly always spinulose.

*Occurrence.*—A highly characteristic although somewhat uncommon fossil of the Mount Auburn member of the McMillan formation at Lebanon and other localities in southwestern Ohio.

#### STOMATOPORA DELICATULA (James).

Plate III, figs. 4-7.

*Hippothoa delicatula* JAMES, Paleontologist, No. 1, 1878, p. 6.

*Stomatopora delicatula* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 419.

*Somatopora proutana* MILLER, Jour. Cincinnati Soc. Nat. Hist., V., 1882, p. 39, pl. 1, figs. 4-4b.

*Somatopora proutana* ULRICH, Geol. and Nat. Hist. Surv., Minnesota, Final Rep., III, Pt. 1, 1893, p. 117, pl. 1, figs. 8-12.

*Rhopalonaria pertenuis* ULRICH, Fourteenth Ann. Rep. Geol. and Nat. Hist. Surv., Minnesota, 1886, p. 59.

*Somatopora tenuissima* ULRICH, Jour. Cincinnati Soc. Nat. Hist., XII, 1890, p. 175, fig. 2.

*Somatopora delicatula-tenuissima* NICKLES and BASSLER, Bull. U. S. Geol. Surv., No. 173, 1900, p. 419.

*Original description.*—"Polyzoary creeping, adnate, branching dichotomously, and sometimes anastomosing. Branches linear, about

one-tenth of a line in diameter. Cells uniserial, each growing by a pointed base from the cell below, and expanding gradually to the mouth; two or three cells in the space of a line. Apertures terminal, elevated, and nearly or quite the diameter of the cells and placed on their front face."

Mr. James's description brings out all the essential features of this variable species. Its constant characters are the elongate, club-shaped zoecia increasing very gradually and regularly in width from the narrow proximal portion to the wider rounded anterior end, where a diameter of about .12 mm. is reached. Considerable variation occurs in the length of zoecia of the same zoarium, so that specific differences made upon this character can not be maintained. At certain horizons, and especially in the Corryville bed, very luxuriant growths of this form are found upon other organisms, and it is in such specimens that the greatest variation is exhibited. Mr. Miller applied the name *S. proutana* to the very elongate form from the Corryville bed at Cincinnati, while specimens with the same characters, but coming from the lower part of the Eden shale were described as *S. tenuissima* by Mr. Ulrich. The form with short zoecia was named *Rhopalonaria pertenuis* by Mr. Ulrich, but later placed by him as a synonym of *S. proutana* Miller. Nickles and the writer recognized Mr. James's name, but considered *S. tenuissima* of sufficient value to rank as a variety. Further study may indicate that this latter form might still be ranked as a variety instead of being considered a synonym as above.

*Occurrence.*—Mr. James's type lot contains specimens from various horizons of the Covington and Richmond groups in southwestern Ohio. The species ranges through the various divisions of the Mohawkian and Cincinnati divisions of the Ordovician, and has also a wide geographical distribution.

#### STROMATOPORA ? LICHENOIDES James.

*Stromatopora ? lichenoides* JAMES, Paleontologist, No. 3, 1879, p. 18.

*Stromatopora ? lichenoides* J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XV, 1892, p. 90.

Although not described as bryozoa, the types of this species prove to belong to this class. All of the specimens are basal expansions of the articulated bryozoan *Arthropora*. Five of the examples are from the Richmond group and are undoubtedly the bases of a form of *Arthropora shafferi* found very abundantly in these rocks; the remaining four specimens are from the Eden shales at Cincinnati and probably belong to *Arthropora cleavelandi* James. Several species of *Arthropora* occur in the Eden, but as *A. cleavelandi* is the most abundant, it is most probable that the Eden specimens are of this species.

## STROMATOPORA TUBULARIS James.

*Stromatopora tubularis* JAMES, Jour. Cincinnati Soc. Nat. Hist., VII, 1884, p. 139, pl. VII, figs. 3-3b.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XV, 1892, p. 89.

"Cylindrical or tubular, hollow, 2 to 2½ inches in diameter and 1 inch or more long; laminae about one-twentieth of an inch thick, irregular, wavy, with serrate edges; interspaces thin; oscula at irregular intervals; central cavity of the tube filled with broken shells, corals, or masses of clay, or sometimes entirely empty."<sup>a</sup>

The type of this so-called *Stromatopora* proves to be a portion of the living chamber of a cephalopod (*Orthoceras* or *Endoceras*), which has become encrusted by successive layers of species of bryozoa belonging to the genus *Ceramoporella*. Some of these layers are of *Ceramoporella distincta* Ulrich, others are of *C. granulosa-milfordensis* (James), while vertical sections indicate that *C. ohioensis* is also present. The "serrate edges" of the "laminae" are seen only in vertical sections or fractures. This toothed appearance is caused by the projecting lunaria of each zoarial layer. The basal lamina of the succeeding layer touches only a few of these projecting points, the others remaining free. The "oscula" at irregular intervals are simply the clay-filled borings of worms or other burrowing organisms.

The type came from the Eden shale at Cincinnati, but similar specimens of incrusting *Ceramoporella* can be found throughout the Cincinnati rocks.

## STROMATOPORA LUDLOWENSIS James.

*Stromatopora ludlowensis* JAMES, Jour. Cincinnati Soc. Nat. Hist., VII, 1884, p. 140, pl. VII, figs. 7, 7a.—J. F. JAMES, Jour. Cincinnati Soc. Nat. Hist., XV, 1892, p. 91.

"Cænosteum varying in outline and size 4½ by 3 inches and 2½ inches thick; sometimes parasitic, and then varying from one-tenth to three-tenths of an inch thick; laminae irregular, undulating, from 4 to 6 in one-tenth of an inch, including interspaces; transverse sections show numerous circular or oval oscula (?) irregularly distributed; surface irregular and rough, showing numerous minute pores and a greater or less number of oscula."<sup>b</sup>

The "cænosteum" of this species instead of forming a tubular structure as in the preceding, grew into solid masses. Moreover, two sets of "oscula" are recognized by its author, one of them doubtful.

The type specimen is an irregular, solid mass composed of successively incrusting layers of *Ceramoporella*, *C. distincta* Ulrich and *C.*

<sup>a</sup> Abridged description by J. F. James, Jour. Cincinnati Soc. Nat. Hist., XV, 1892, p. 89.

<sup>b</sup> Abridged description by J. F. James, Jour. Cincinnati Soc. Nat. Hist., XV, 1892, p. 91.

*granulosa-milfordensis* (James) being the species observed. The larger and doubtful set of "oscula" is made up, as in *S. tubularis*, of clay-filled burrows, while the smaller set is composed of the mouths of the zoecia themselves.

The species of *Ceramoporella* seem to have bothered Mr. James considerably. This is especially true of *C. distincta*, the type lots of no less than seven of his species containing unquestionable examples of this common form.

#### INDEX OF JAMES'S NAMES.<sup>a</sup>

*Alecto nexilis* James.

*Callopora milfordensis* James. (See *Ceramoporella granulosa-milfordensis*.)

*Ceramopora alternata* James. (See *Cleoclema alternatum*.)

*Ceramopora* ? *beani* James. (See *Paleschara beani*.)

*Ceramopora concentrica* James.

*Ceramopora* ? *irregularis* James.

*Ceramopora nicholsoni* James.

*Ceramopora radiata* James.

*Ceramopora whitei* James. (See *Ceramoporella whitei*.)

*Chaetetes harrandei* ? James (not Nicholson). (See *Hemiphragma whitfieldi*.)

*Chaetetes* ? *calycula* James. (See *Aspidopora calycula*.)

*Chaetetes cincinnatiensis* James. (See *Monticulipora cincinnatiensis*.)

*Chaetetes* ? *clathratulus* James. (See *Escharopora parvonia*.)

*Chaetetes claracoidea* James. (See *Leptotrypa claracoidea*.)

*Chaetetes claracoideus* James. (See *Leptotrypa claracoidea*.)

*Chaetetes crustulatus* James.

*Chaetetes discoidea* James. (See *Amplexopora discoidea*.)

*Chaetetes gracilis* James. (See *Bythopora gracilis*.)

*Chaetetes lycoperdon* (Say) James.

*Chaetetes lycopodites* (Vanuxem) James.

*Chaetetes meeki* James. (See *Bythopora meeki*.)

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*Chaetetes petropolitanus* (Pander) James.

*Chaetetes subrotundus* James.

*Chaetetes turbinatum* James.

*Chaetetes varians* James. (See *Batostoma varians*.)

*Dekayia maculata* James.

*Escharina* ? *distorta* James. (See *Rhinopora verrucosa* Hall.)

*Fistulipora* ? *multiopora* James.

*Fistulipora oweni* James. (See *Cleoclema oweni*.)

*Fistulipora siluriana* James.

*Helopora approximata* James.

*Helopora dendrina* James. (See *Bythopora dendrina*.)

*Helopora harrisi* James.

*Helopora meeki* James. (See *Dicranopora meeki*.)

*Helopora parrula* James. (See *Bythopora parrula*.)

*Helopora tenuis* James. (See *Arthrostylus tenuis*.)

*Hippothoa delicatula* James. (See *Stomatopora delicatula*.)

*Lichenalia calycula* James. (See *Aspidopora calycula*.)

<sup>a</sup> The species discussed in this paper are arranged alphabetically and this index is given in order to facilitate the finding of the James species as now placed.

- Monotrypa undulata-hemispherica* J. F. James.  
*Monticulipora calycula* James. (See *Aspidopora calycula*.)  
*Monticulipora cincinnatiensis* James.  
*Monticulipora claracoides* James. (See *Leptotrypa claracoides*.)  
*Monticulipora cleavelandi* James.  
*Monticulipora clintonensis* James.  
*Monticulipora communis* James. (See *Callopora onealli-communis*.)  
*Monticulipora crustulata* James.  
*Monticulipora discoides* James. (See *Amplexopora discoides*.)  
*Monticulipora dychei* James. (See *Stigmatella dychei*.)  
*Monticulipora eccentrica* James. (See *Aspidopora eccentrica*.)  
*Monticulipora fulesi* James. (See *Prasopora fulesi*.)  
*Monticulipora fusiformis* James (not Whitfield). (See *Lioclemella subfusiformis*.)  
*Monticulipora gracilis* James. (See *Bythopora gracilis*.)  
*Monticulipora hospitalis* var. *neglecta* James.  
*Monticulipora kentuckensis* James. (See *Callopora multitabulata*.)  
*Monticulipora lens* James (not McCoy). (See *Calloporella circularis*.)  
*Monticulipora meeki* James. (See *Bythopora meeki*.)  
*Monticulipora ohioensis* James. (See *Dekayella ulrichi*.)  
*Monticulipora onealli* James. (See *Callopora onealli*.)  
*Monticulipora papillata* (McCoy) James and James.  
*Monticulipora petasiformis* var. *welchi* James. (See *Amplexopora petasiformis welchi*.)  
*Monticulipora subcylindrica* J. F. James. (See *Amplexopora filiosa*.)  
*Monticulipora turbinata* James.  
*Monticulipora undulata* var. *hemispherica* J. F. James. (See *Monotrypa undulata hemispherica*.)  
*Monticulipora varians* James. (See *Batostoma varians*.)  
*Monticulipora whitfieldi* James. (See *Hemiphragma whitfieldi*.)  
*Monticulipora wortheni* James. (See *Homotrypa wortheni*.)  
*Monticulipora* (*Chaetetes*) *meeki* James. (See *Bythopora meeki*.)  
*Monticulipora* (*Chaetetes*) *varians* James. (See *Batostoma varians*.)  
*Monticulipora* (*Chaetetes*) *whitfieldi* James. (See *Hemiphragma whitfieldi*.)  
*Monticulipora* (*Dekayia*) *maculata* James. (See *Dekayia maculata*.)  
*Monticulipora* (*Fistulipora*) *alternata* James. (See *Coeloclema alternatum*.)  
*Monticulipora* (*Fistulipora*) *milfordensis* James. (See *Ceramoporella granulosa milfordensis*.)  
*Monticulipora* (*Fistulipora*) *nicholsoni* James.  
*Monticulipora oweni* James. (See *Coeloclema oweni*.)  
*Monticulipora* (*Heterotrypa*) *circularis* James. (See *Calloporella circularis*.)  
*Monticulipora* (*Heterotrypa*?) *cleavelandi* James. (See *Monticulipora cleavelandi*.)  
*Monticulipora* (*Heterotrypa*) *clintonensis* James.  
*Monticulipora* (*Heterotrypa*?) *eccentrica* James. (See *Aspidopora eccentrica*.)  
*Monticulipora* (*Heterotrypa*) *onealli*? var. *communis* James. (See *Callopora onealli communis*.)  
*Monticulipora* (*Heterotrypa*) *winchelli* James. (See *Prasopora hospitalis*.)  
*Monticulipora* (*Monotrypa*) *dychei* James. (See *Stigmatella dychei*.)  
*Monticulipora* (*Monotrypa*?) *subfusiformis* James. (See *Lioclemella subfusiformis*.)  
*Monticulipora* (*Monotrypa*) *welchi* James. (See *Amplexopora petasiformis welchi*.)  
*Monticulipora* (*Monotrypa*) *wortheni* James. (See *Homotrypa wortheni*.)  
*Psilodictya acuminata* James. (See *Escharopora acuminata*.)  
*Psilodictya antiqua* James. (See *Eurydictya multipora*.)  
*Psilodictya*? *cincinnatiensis* James. (See *Arthropora cincinnatiensis*.)  
*Psilodictya cleavelandi* James. (See *Arthropora cleavelandi*.)  
*Psilodictya clintonensis* James. (See *Psilodictya nodosa*.)

- Ptilodictya dubia* James. (See *Arthropora cleavelandi*.)  
*Ptilodictya fimbriata* James. (See *Phænopora fimbriata*.)  
*Ptilodictya flexuosa* James. (See *Stictoporella flexuosa*.)  
*Ptilodictya grahami* James. (See *Arthropora cleavelandi*.)  
*Ptilodictya granulosa* James. (See *Rhinidictya parallela*.)  
*Ptilodictya hilli* James. (See *Escharopora hilli*.)  
*Ptilodictya kentuckyensis* James. (See *Arthropora kentuckyensis*.)  
*Ptilodictya nodosa* James.  
*Ptilodictya parallela* James. (See *Rhinidictya parallela*.)  
*Ptilodictya platyphylla* James. (See *Phænopora expansa*.)  
*Ptilodictya plumaria* James.  
*Ptilodictya teres* James. (See *Ptilodictya nodosa*.)  
*Ptilodictya welshi* James.  
*Sagenella striata* James.  
*Stictopora clathratula* James. (See *Escharopora pavonia*.)  
*Stromatopora* ? *lichenoides* James.  
*Stromatopora ludlowensis* James.  
*Stromatopora tubularis* James.

### EXPLANATION OF PLATES.

#### PLATE I.

##### *Prasopora falesi* (James).

Figs. 1 and 2. Tangential section,  $\times 20$ , and portion of same,  $\times 35$ , showing the usual characters of this species as restricted and here redefined. The small acanthopores which seem to be confined to the vicinity of the maculae are especially characteristic.

3 and 4. Vertical section,  $\times 20$ , and portion of same,  $\times 35$ , showing the tabulation of the zoecial tubes and mesopores and the acanthopores as they appear when cut lengthwise.

Lexington limestone, Danville, Kentucky.

##### *Callopora multitabulata* (Ulrich).

5 and 6. Views of tangential and vertical sections,  $\times 20$ , drawn from the same sections used by James in attempting to illustrate the internal structure of his *Monticulipora kentuckensis*.

7. A few zoecia of fig. 5,  $\times 35$ , illustrating the minute structure of the walls.

Lexington limestone, Paris, Kentucky.

##### *Aspidopora calycula* (James).

8 and 9. Tangential section,  $\times 20$ , and a portion of same,  $\times 35$ , of an average example of this well-marked species.

10. Vertical section  $\times 20$ , showing as usual only a single large cystiphragm at the base of the zoecial tubes.

Bromley shale, Ohio River bank, West Covington, Kentucky.

##### *Eurydictya multipora* (? Hall) Ulrich.

11 and 12. Tangential and vertical sections,  $\times 20$ , prepared from James's type of *Ptilodictya antiqua* and showing the usual characters of the species to which it is now referred.

Lexington limestone, near Harrodsburg, Kentucky.

*Callopora onealli communis* (James).

(See also Plate IV, figs. 8 and 9.)

FIG. 13. Tangential section,  $\times 20$ , of an average example, exhibiting the few mesopores and angular zoecia marking this variety, and the wall structure of a *Callopora*.

McMicken member of the Eden shale. Cincinnati, Ohio.

PLATE II.

*Bythopora arctipora* (Nicholson).

1 and 2. Tangential and vertical sections, respectively,  $\times 20$ , of one of the originals of *Chaetetes minutus* James. The external characters as well as the internal features shown in these figures are precisely the same as in the form previously described by Nicholson as *Ptilodictya arctipora*.

McMicken member of Eden shale, near Loveland, Ohio.

*Dekayella ulrichi* (Nicholson).

3. A few cells of a tangential section,  $\times 35$ .

4. Portion of the peripheral region of a vertical section,  $\times 20$ . These figures were drawn from sections prepared from the type of *Monticulipora ohioensis* James. The internal characters are in all respects like those of *D. ulrichi*.

Eden shale, Cincinnati, Ohio.

*Rhinidictya parallela* (James).

(See also Plate V, figs. 2, 3.)

5. Tangential section,  $\times 20$ , of stipe taken just beneath a bifurcation and showing the aged condition of this species distinguished by James as *Ptilodictya granulosa*.

6. Tangential section,  $\times 20$ , of a younger branch agreeing with the original of *Ptilodictya parallela* James.

7. Vertical section,  $\times 20$ , prepared from the same specimen as fig. 6.

Economy member of Eden shale, Cincinnati, Ohio.

*Aspidopora eccentrica* (James).

(See also Plate V, figs. 7, 8.)

8 and 9. Tangential and vertical sections,  $\times 20$ , drawn from James's type sections.

10 and 11. Tangential section of another specimen,  $\times 20$ , and a small portion of same,  $\times 35$ .

12. Vertical section,  $\times 20$ , showing nearly the entire width of one of the small disks of this species.

Southgate member of Eden shale, Cincinnati, Ohio.

*Dekayia maculata* (James).

13. Vertical section,  $\times 20$ , of an average example, containing rather more of the extremely delicate diaphragms than usual.

14. Tangential section of same,  $\times 20$ , showing one of the maculae which often occur, and the thick walls characterizing the species.

These sections were prepared from James's type of the species.

McMicken member of the Eden shale, Loveland, Ohio.

*Hemiphragma whitfieldi* (James).

(See also Plate IV, figs. 1-4; plate V, fig. 5.)

FIG. 15. Tangential section,  $\times 20$ , showing many of the zoecia with sections of the semidiaphragms.

16. Vertical section,  $\times 20$ , showing undulating walls in axial region, complete diaphragms in outer part of same and semidiaphragms in the thick-walled peripheral region. These incomplete diaphragms are distinctive of *Hemiphragma*.

Economy member of the Eden shale, Cincinnati, Ohio.

## PLATE III.

*Amplexopora filiosa* (D'Orbigny).

1. Tangential section,  $\times 20$ , the upper half of figure showing the characters of the mature region, the lower half those of the immature zone.
2. Tangential section through the mature region,  $\times 35$ , exhibiting the numerous acanthopores and the dark line separating adjoining zoecia.
3. Vertical section,  $\times 12$ , showing two successive alternate pairs of immature and mature zones and above these a longer immature zone. The figure brings out the difference in wall structure and tabulation characterizing the respective regions or zones.

Sections prepared from the figured type of *Monticulipora subcylindrica* James.

Fairview formation, Cincinnati, Ohio.

*Stomatopora delicatula* (James).

- 4 and 5. Portion of a zoarium  $\times 12$  and three zoecia,  $\times 20$ , of the form to which Miller applied the name *S. proutana*.

Bellevue bed of the Fairview formation, Cincinnati, Ohio.

6. Portion of zoarium,  $\times 12$ , showing variations in the length of zoecia. In many specimens the general proportions of the zoecia in the lower half of the figure is constant.

Corryville bed of McMillan formation, Cincinnati, Ohio.

7. Several zoecia,  $\times 12$ , of the form named *S. tenuissima* by Ulrich.

Economy member of Eden shale, Cincinnati, Ohio.

The specimens illustrated here were selected from the lot marked as the types of his species by Mr. James.

*Stigmatella dychei* (James).

8. Tangential sections,  $\times 20$ , the upper and lower halves exhibiting the characters of the mature and immature regions, respectively. It should be remarked that the larger size of the zoecia in the upper half of the figure is due to the fact that it includes a large part of one of the maculae.
9. Tangential section,  $\times 50$ , showing minute structure of walls and acanthopores.
10. Vertical section,  $\times 12$ , passing through successive pairs of immature and mature zones.

Sections prepared from James's figured type of the species.

Mt. Auburn member of the McMillan formation, Lebanon, Ohio.

*Bythopora parvula* (James).

(See also Plate V, fig. 4.)

Figs. 11 and 12. Tangential and vertical sections,  $\times 20$ , prepared from one of the types of this delicate bryozoan.

McMicken member of the Eden shales, Loveland, Ohio.

*Arthropora cleavelandi* (James).

(See also Plate IV, fig. 6.)

13. Outline drawing of type of *Ptilodictya cleavelandi* James,  $\times 2$ . This illustrates the usual form of the upper segments of the zoaria of this species.
- 14 and 15. Outline drawings of the type specimens of *P. grahami* James. These are bifurcated initial segments.
16. Outline drawing of type of *P. dubia* James,  $\times 2$ . This also is an initial segment of the same species as the original of *P. cleavelandi*, but differs in its simple, unbifurcated, upper articulating extremity.

All of the specimens are from the Eden shales at Cincinnati, Ohio.

## PLATE IV.

*Hemiphragma whitfieldi* (James).

(See also Plate II, figs. 15, 16; plate V, fig. 5.)

- 1 and 2. Views of two of the James type specimens,  $\times 1.5$ .  
Economy member of Eden shales, Cincinnati, Ohio.
- 3 and 4. Two fragments of a more robust form of this species,  $\times 1.5$ .  
Southgate member of Eden shales, Covington, Kentucky.

*Arthropora kentuckyensis* (James).

5. View of the type and only known specimen of this incompletely known species,  $\times 6$ . The lower part of the specimen is broken away but doubtless was originally obtusely pointed.

Bromley shales of the Trenton, Ohio River bank, opposite Cincinnati, Ohio.

*Arthropora cleavelandi* (James).

(See also Plate III, figs. 13-16.)

6. A complete segment of this species,  $\times 6$ , showing the comparatively slender habit of growth and the short lateral branches which diverge very nearly at right angles and are particularly characteristic.
- McMicken member of the Eden shales, Cincinnati, Ohio.

*Arthropora cincinnatiensis* (James).

7. View of the specimen marked as the type of this species,  $\times 6$ . It is merely one of the separated segments but is in a good state of preservation and quite typical.

Mt. Hope member of the Fairview formation, Cincinnati, Ohio.

*Callopora onealli communis* (James).

(See also Plate I, fig. 13.)

FIGS. 8 and 9. Two fragments of this robust variety,  $\times 1.5$ .

McMicken member of the Eden shale, Cincinnati, Ohio.

## PLATE V.

*Dicranopora meeki* (James).

1. View of a portion of the surface of the slab containing the types of this species,  $\times 6$ . The figure contains two simple and one bifurcated segments and exhibits the elongate, narrow, subcylindrical form distinguishing the joints of this delicate bryozoan.

Mt. Hope member of the Fairview formation, Cincinnati, Ohio.

*Rhinidictya parallela* (James).

(See also Plate II, figs. 5-7.)

2. View of the type specimen of *Ptilodictya granulosa* James,  $\times 6$ , showing the thickened granulose walls found in old examples.
3. View of the type of *Ptilodictya parallela* James,  $\times 1.5$ . It is the central stipe in the figure and partly covered by the free cheek of an *Acidaspis*.

Economy member of Eden shales, Cincinnati, Ohio.

*Bythopora parvula* (James).

(See also Plate III, figs. 11, 12.)

4. Surface of slab bearing type specimens,  $\times 1.5$ , showing several branches within the space outlined with ink.

McMicken member of Eden shales, Loveland, Ohio.

*Hemiphragma whitfieldi* (James).

(See also Plate II, figs. 15, 16; plate IV, figs. 1-4.)

5. Perfectly cleaned surface of specimen showing semidiaphragms within zoecia,  $\times 8$ .

Southgate member of Eden shales, West Covington, Kentucky.

*Ceramoporella whitei* (James).

(See also Plate VI, figs. 8-10.)

6. Surface of James's type,  $\times 8$ , showing the nearly direct apertures and inconspicuous lunaria, which features distinguish the species from the otherwise similar *C. ohioensis* (Nicholson).

Corryville member of the McMillan formation, Cincinnati, Ohio.

*Aspidopora eccentrica* (James).

(See also Plate II, figs. 8-12.)

7. The underside of a specimen of this peculiar species,  $\times$  by 8, showing the eccentric striation of this surface.
8. Upper, celluliferous surface of another example,  $\times 8$ .

Southgate member of Eden shales, Cincinnati, Ohio.

## PLATE VI.

*Callopora onealli* (James).

FIGS. 1 and 2. Views of two of the type specimens,  $\times 1.5$ .

Economy member of Eden shales, Cincinnati, Ohio.

*Callopora onealli sigillarioides* (Nicholson).

3 and 4. Views of two typical examples,  $\times 1.5$ , introduced for comparison with *C. onealli*.

McMicken member of Utica shales, Cincinnati, Ohio.

*Cocloctema oveni* (James).

5. Vertical section,  $\times 20$ .

6. Tangential section,  $\times 20$ , showing the large prominent lunaria and the resulting bilobed appearance of the zoecia.

Mt. Auburn member, Lebanon, Ohio.

*Ceramoporella granulosa milfordensis* (James).

7. Tangential section of a portion of a macula,  $\times 35$ . In this region alone a few granules are developed.

Eden shales, Milford, Ohio.

*Ceramoporella whitei* (James).

(See also Plate V, fig.  $\beta$ .)

8 and 9. Tangential sections,  $\times 20$  and  $35$ , respectively, showing the usual aspect of this species.

10. One layer of zoecia of a vertical section,  $\times 20$ .

Corryville member, Cincinnati, Ohio.

## PLATE VII.

*Prasopora hospitalis* (Nicholson).

1. Vertical section of the basal part of the zoarium,  $\times 20$ , drawn from James's type section of *Monticulipora winchelli*. The section, partly on account of an error in the preparation, shows only curved tabulae as described by Mr. James, instead of the usual cystiphragms.

2. Vertical section,  $\times 20$ , exhibiting the shape and distribution of the cystiphragms in the mature region.

3. Tangential section of the mature region,  $\times 35$ . The large acanthopores especially characteristic of *P. hospitalis* are well brought out in the section.

Figs. 2 and 3 were drawn from thin sections prepared from the same specimen used by Mr. James in describing and illustrating his species.

Richmond group, near Lynchburg, Highland County, Ohio.

*Lioclemella subfusiformis* (James).

4. Vertical section,  $\times 20$ , of a zoarium showing the untabulated zoecia and the closely tabulated mesopores, the latter being restricted to the peripheral region.

FIGS. 5 and 6. Tangential sections,  $\times 20$  and  $\times 35$ . The angular thin-walled zoecia and mesopores often closely resemble each other, but the more rounded form and slightly thicker walls of the former will serve as a means of distinguishing them.

7. Natural size views of three of the type specimens figured by James.  
Waynesville formation of the Richmond group, Westboro, Ohio.

*Helopora harrisi* (James).

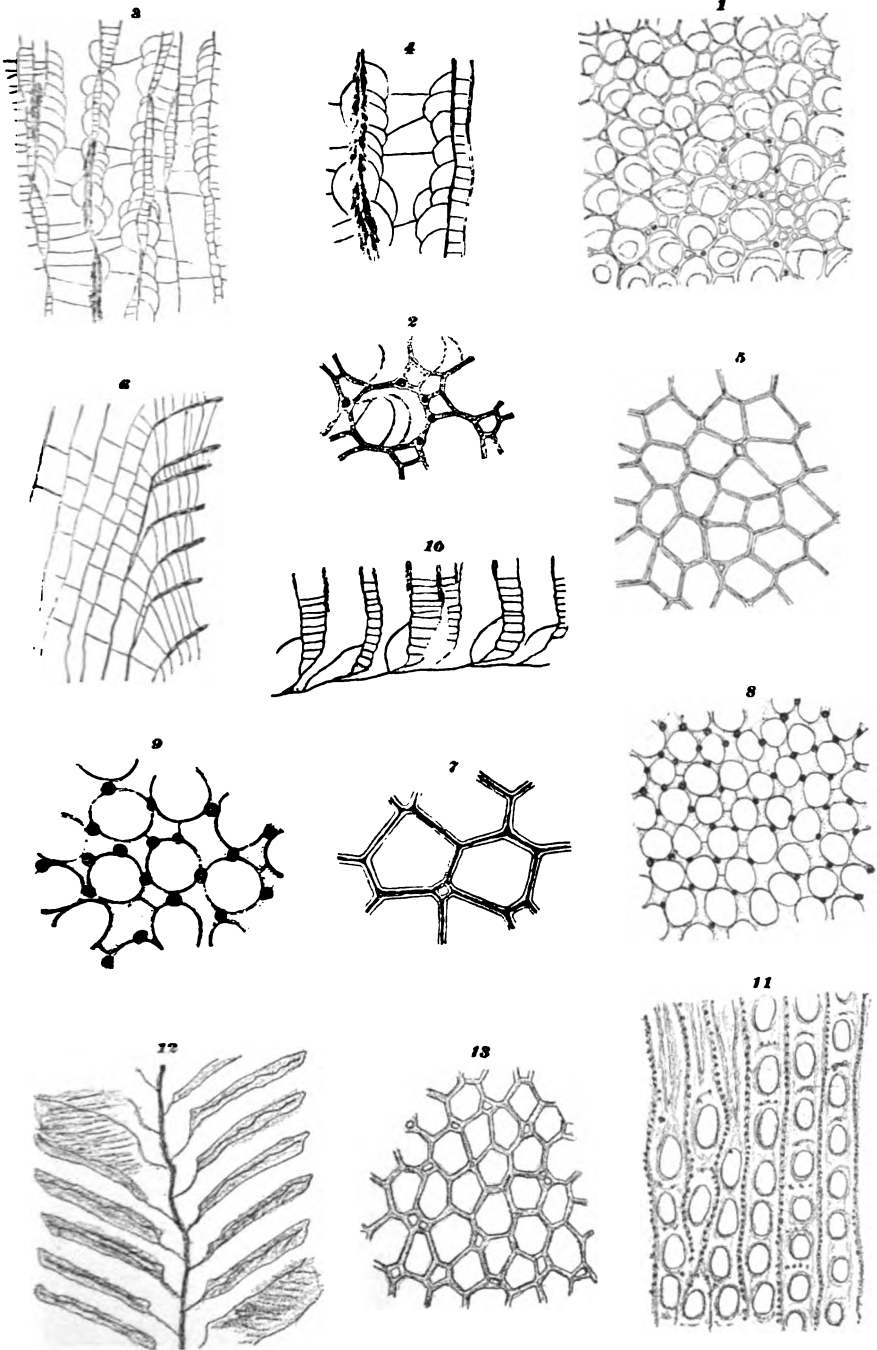
8. Two segments,  $\times 12$ , from type locality (after Ulrich).  
Waynesville formation of the Richmond group, Waynesville, Ohio.

*Batostoma variabile* Ulrich (restricted).

9. Vertical section,  $\times 20$ , passing through the mature and a portion of the immature region.  
10. Tangential section,  $\times 20$ , exhibiting the angular, thick-walled contiguous zoecia, the comparatively small acanthopores and the absence of mesopores.  
Top of Richmond group, Osgood, Indiana.

*Phænopora fimbriata* (James).

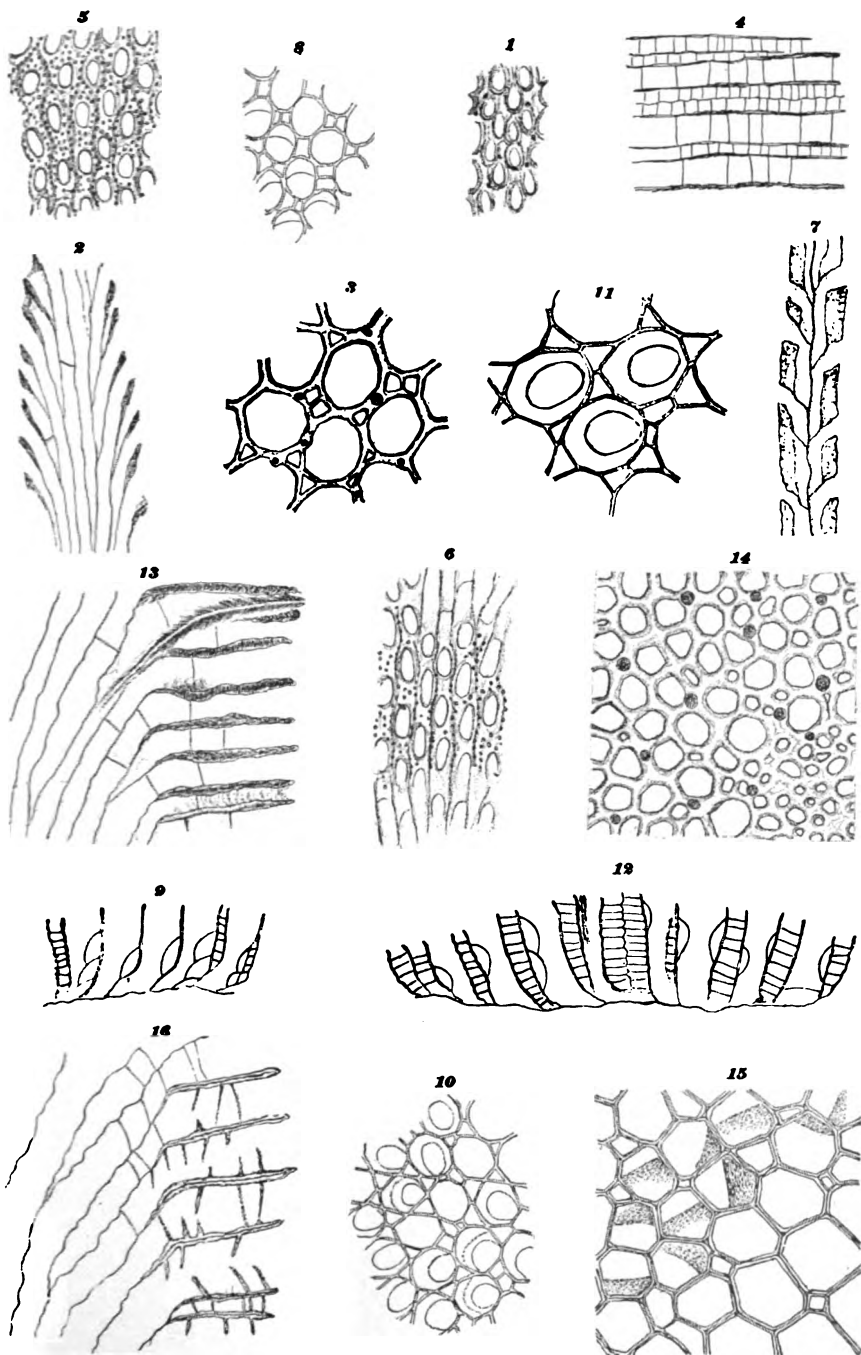
11. Outline drawing of the type specimen, the basal extremity restored; natural size.  
12. Tangential section of type,  $\times 20$ .  
Clinton formation, Clinton County, Ohio.



JAMES TYPES OF ORDOVICIAN BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 60, 61.

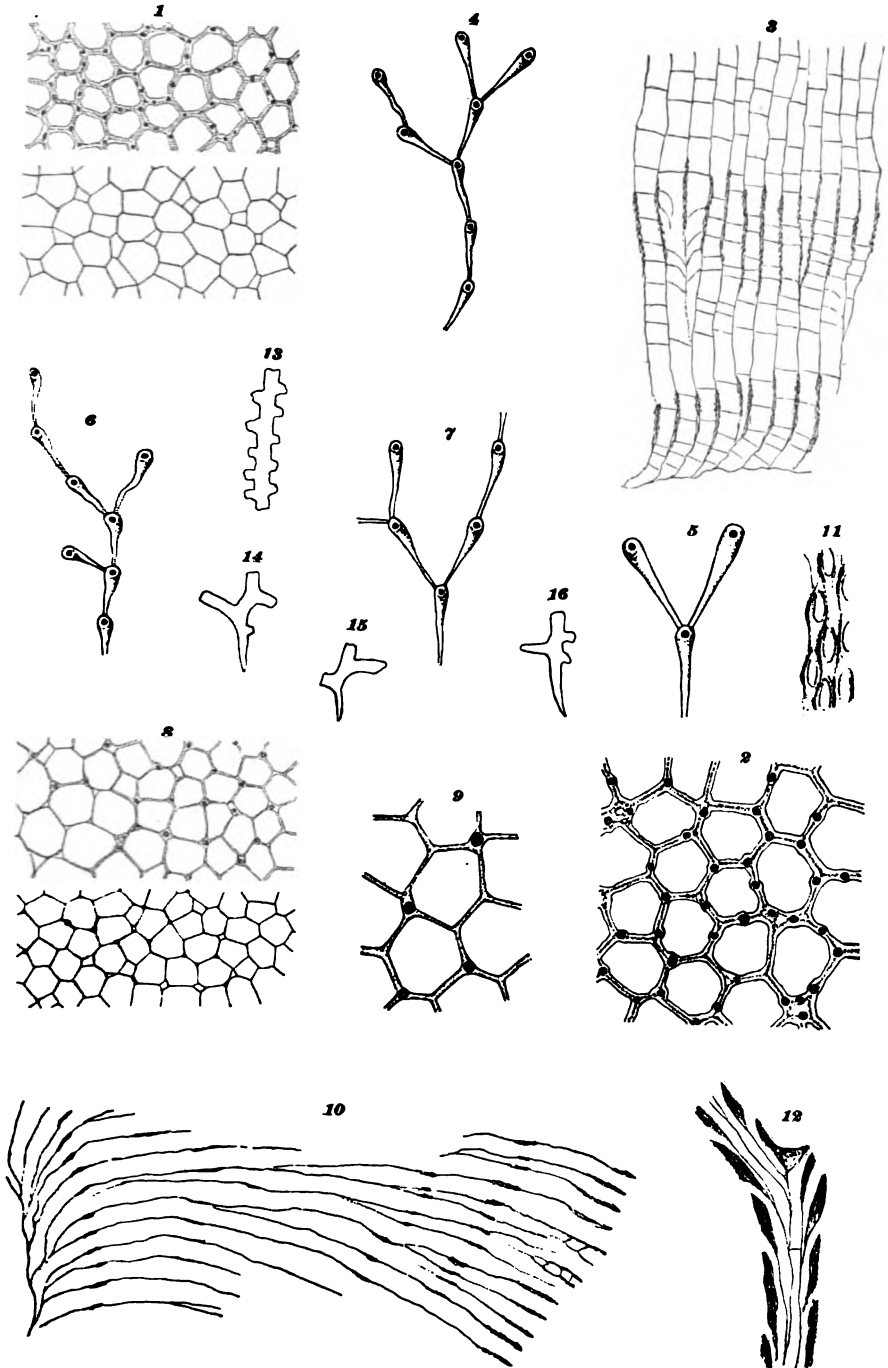




JAMES TYPES OF ORDOVICIAN BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 61, 62.

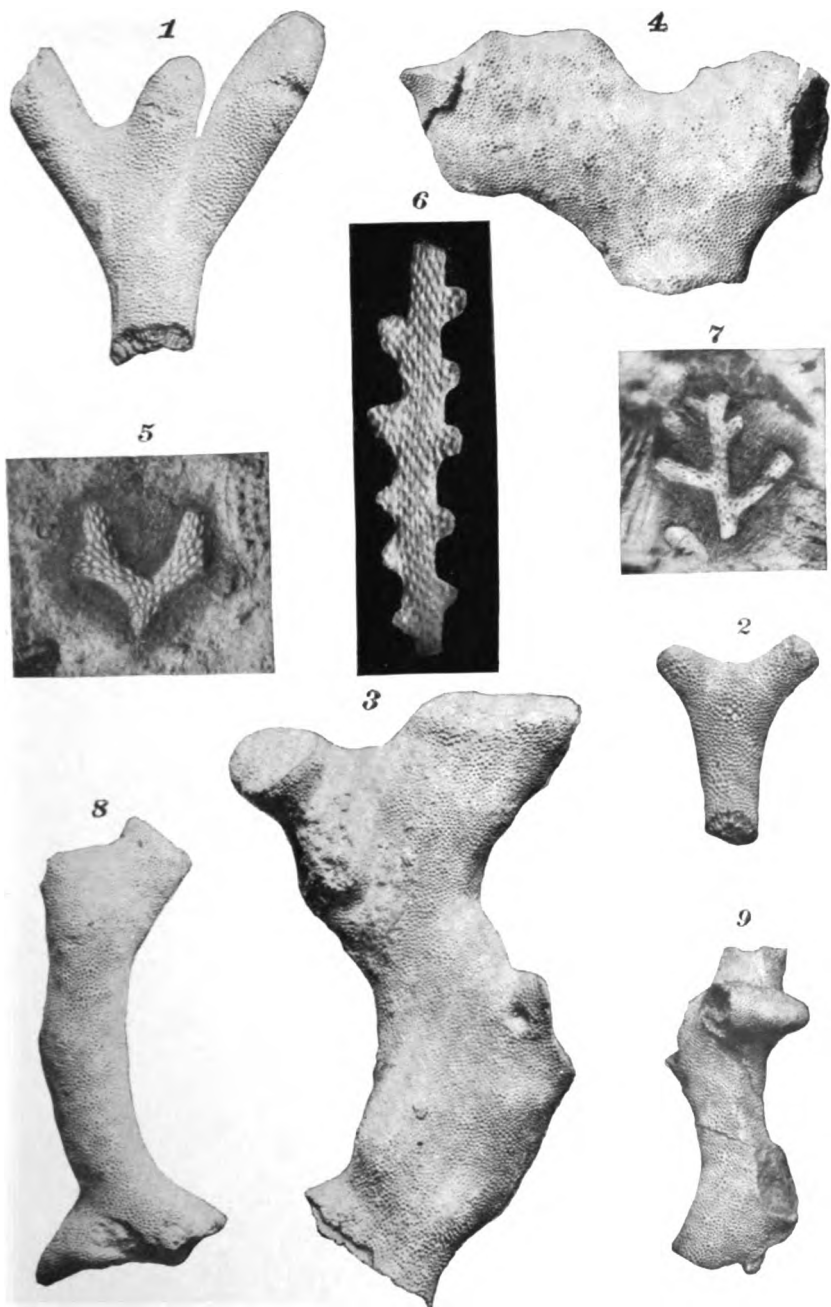




JAMES TYPES OF ORDOVICIAN BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 62, 63.





JAMES TYPES OF ORDOVICIAN BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 63, 64.



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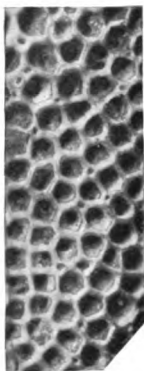
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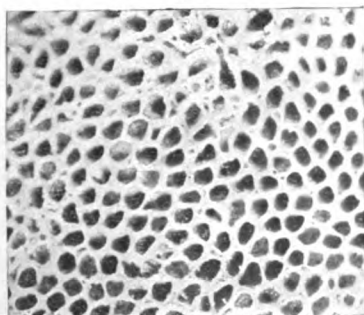
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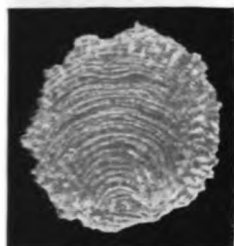
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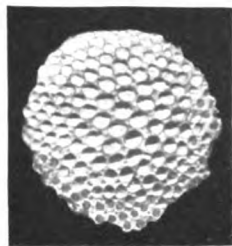
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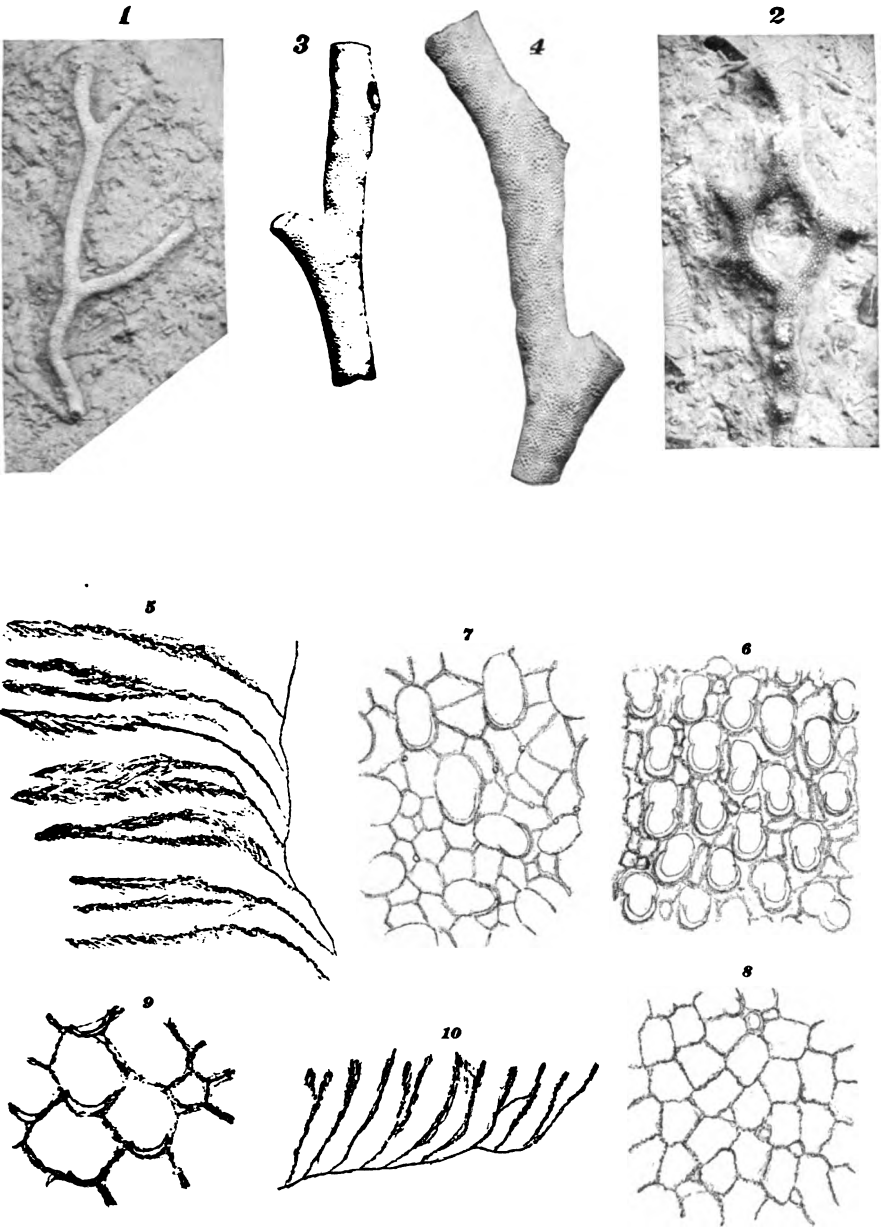
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JAMES TYPES OF ORDOVICIAN BRYOZOA.

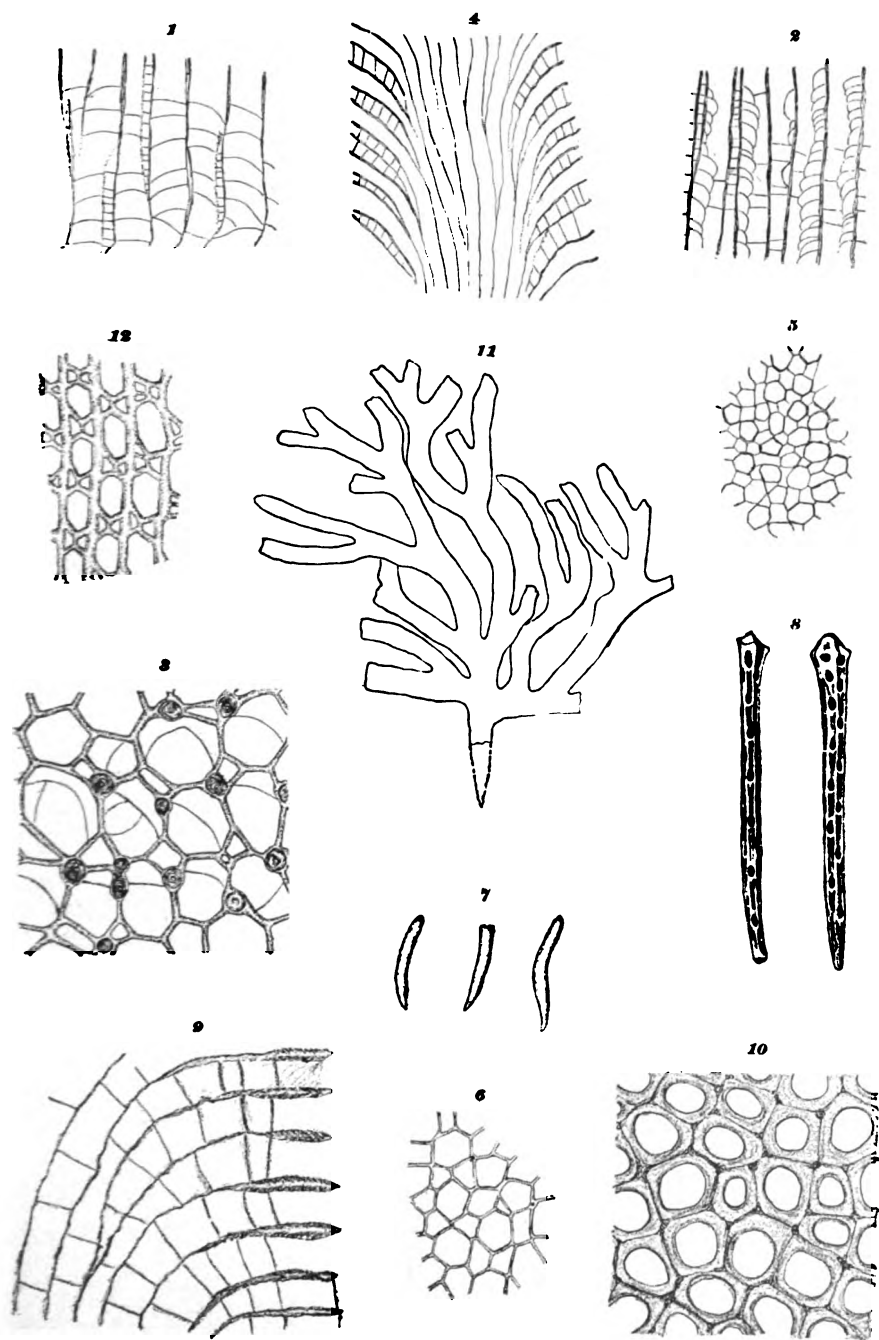
FOR EXPLANATION OF PLATE SEE PAGE 64.





JAMES TYPES OF ORDOVICIAN BRYOZOA.  
FOR EXPLANATION OF PLATE SEE PAGE 65.





JAMES TYPES OF ORDOVICIAN AND SILURIAN BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 65, 66.



# THE LIFE HISTORY OF THE CAVE SALAMANDER, *SPELERPES MACULICAUDUS* (COPE).

By ARTHUR M. BANTA and WALDO L. MCATEE.

*Of the University of Indiana.*

During the past two years the senior author has been engaged in a study of the animal ecology of Mayfield's cave, near Bloomington, Indiana. An attempt has been made to work out the distribution, life history, etc., of as many of the species inhabiting that cave as possible. The present paper is an excerpt from the larger one and gives the results of the work on the common cave salamander. It is based largely upon collections made by the authors, but free use has been made of material contained in the United States National Museum.

## GENERAL ACCOUNT.

### REFERENCES TO LITERATURE.

The cave salamander, *Spelerpes maculicaudus* (Cope), was, until comparatively recently, confounded with its near relative and associate, *Spelerpes longicaudus* (Green). The following references pertain to *maculicaudus* exclusively:

*Gyrinophilus maculicaudus* COPE, Am. Nat., XXIV, 1890, p. 966, fig.—(Brookville, Indiana).—BUTLER, Journ. Cin. Soc. Nat. Hist., XIV, 1892, p. 172. (Brookville, Indiana; Northeastern Franklin County; Westport, Decatur County.)

*Spelerpes maculicaudus* HAY, Am. Nat., XXV, 1891, p. 1135 (Brookville, Indiana, p. 1133; Bloomington, Indiana; May's Cave, near Bloomington; Kern's Cave, near Bedford, Indiana); Ann. Rept. Dept. Geol. Ind. (1891), 1892, p. 447, pl. 1, fig. 4. (Brookville, Indiana; Bloomington, Indiana; May's Cave, near Bloomington; Kern's Cave, near Bedford; Decatur County; and small cave, near Wyandotte Cave, Indiana; Barry County, Missouri, p. 448).—GAINES, Am. Nat., XXIX, 1895, p. 55 (Vincennes, Indiana).—COPE, Ann. Rept. Smiths. Inst. (1898), 1900, p. 1213 (Transalleghean district of the Carolinian Faunal area).—EIGENMANN, Trans. Am. Micr. Soc., XXII, 1901, pp. 189-91, pl. xxvii (Rockhouse Cave, Wilson's Cave, and Marble Cave, Missouri; Brookville, Wyandotte Cave, and Bloomington, Indiana).—EIGENMANN and KENNEDY, Biol. Bull., IV, No. 5, 1903, pp. 227-8, fig. 1 (Marble Cave and Rockhouse Cave, Missouri).

*Spelerpes maculicauda* BLATCHLEY, Ann. Rep. Dept. Geol. Ind., (1896), 1897, pp. 125-183 (Porter's Cave, Owen County, Indiana; Donnehue's Cave, Lawrence County; Clifty Cave, Washington County; Marengo Cave, Wyandotte Cave, Little Wyandotte Cave, Saltpeter Cave, and Sibert's Well Cave, Crawford County; Indian Springs, Martin County; Donnelson's Cave, Lawrence County; May's Cave, Monroe County; Kern's Cave, Lawrence County).—EIGENMANN, Pop. Sci. Mo., LVI, 1899-1900, p. 474, fig. 1 (Caves of Eastern U. S.); Proc. Ind. Ac. Sci. (1899), 1900, pp. 31-3 (Caves of Mississippi Valley); Science, n. s., XI, p. 493 (Caves of Mississippi Valley); Trans. Am. Micr. Soc., XXI (1899), 1900, p. 49 (Caves of Mississippi Valley).

#### DISTRIBUTION, HABITS, AND HABITAT.

The Cave Salamander<sup>a</sup> (fig. 1) is confined to the Mississippi Valley. It has been collected from 2 stations in Tennessee, 1 in West Virginia, 1 in Kentucky, 26 in Indiana, and 5 in Missouri.



FIG. 1.—ADULT SPELERPES MACULICAUDUS.

All of these localities are within the borders of the Carolinian faunal area (and restricted, obviously, to the Transallegheanian district thereof), a fact which sufficiently attests to the animal's status as a characteristic Carolinian species.

It is most commonly found in caves, and as a rule occurs at no great distance from the mouth, usually barely beyond twilight. Thus in Mayfield's Cave it has been found much oftener near the entrance than farther in, and the same is true of Truitt's Cave, also in Monroe County, Indiana, and the Twin Caves, in Mitchell, Indiana. Doctor Eigemann found it only near the mouths of Wilson's, Marble, and Rock House caves, Missouri. It sometimes ventures into the deeper recesses, however, being reported from a spot  $1\frac{1}{4}$  miles within Wyandotte Cave, and it regularly resorts to such places to lay its eggs. The larvæ have been found in the remoter portions of Wyandotte, Mayfield's, and Mammoth caves. The Cave Salamander is likely to be found around springs originating from caves, and indeed at any point along the streams these feed. The nearly mature larvæ particularly are apt to occur in such situations.

Occasionally *S. maculicauda* is found away from the vicinity of caves. Mr. W. P. Hay writes us as follows concerning this point:

In 1899 and 1900 I found *S. maculicauda* and *S. longicauda* in considerable numbers in West Virginia, both in limestone caverns and in the forest under logs. In

<sup>a</sup> It has also been called the "Hoosier salamander" and the "Spotted-tailed salamander."

the caverns *S. longicaudus* was much more common, while in the woods the two species occurred in about equal numbers.

Blatchley records finding two specimens beneath logs in Monroe County, Indiana, a mile or more from any known cave and half that distance from springs or streams. Its occurrence at Brookville and Vincennes, Indiana, and in Decatur County, localities not in characteristic cave regions, further indicates that it is more or less independent of caves.

This account, however, has to do with the species particularly as a cave inhabitant. In Mayfield's Cave it is doubtless fairly common, but is only occasionally seen and then usually not in remote parts of the cavern. Nearly all of the adults seen have occurred between 60 and 150 feet from the mouth. Four, however, were observed in a passage 572 feet back, another at the edge of a shallow pool at 1,200 feet, and a recently matured specimen was collected 1,470 feet from the mouth.

The latter occurrence is readily to be understood because the larvæ are hatched and develop in these deeper fastnesses. Indeed, the whole character of the salamander's distribution in the cave results from this habit. The younger larvæ occur in the remoter parts. After, and even before transformation there is a gradual movement toward the mouth; here the adults—splendid fellows—are most numerous. Depredations of enemies and escape to the outer world regulate their number. That adults are found in the deeper portions of the cave is probably due in most cases to the necessity of laying their eggs in water, of which there is usually none near the entrance. When larvæ are found at the mouth or even outside of the cave it is probable that in most cases they were carried there by freshets.

Within the cave the adults are generally found in a crevice or upon a shelf of the wall. Only three have been observed on the floor. Their favorite resting places, therefore, are to be reached only by climbing. But this is an easy feat for *S. maculicaudus*, as the following will illustrate: At a point 572 feet back two were seen near each other in a cranny near the roof above a 15-foot embankment of earth, while on the opposite side of the passage one had ascended more than 10 feet on a perpendicular surface of stone. In scaling such places they are probably materially assisted by their tails. These are prehensile to quite a degree, enabling the salamander to support itself by the tail alone. The ability of the animals to climb is more severely tested when they are confined in glass jars. Yet they ascend vertical and even overhanging surfaces and usually remain clinging at the highest point.

When thus settled in a comfortable position the salamander is not easily induced to move. In the cave it is not readily disturbed by a light or by an object moving near. While light of itself will rarely

cause it to stir, the heat of a candle or occasionally the near approach of an object will arouse it to action. Its actions when touched are almost galvanic; leaping a foot or more at the first move, it continues to retreat for several feet by a series of leaps and wriggles. Having placed some distance between itself and the cause of its fright it again becomes quiet and is almost as hard to disturb as before.

This apparent apathy even in the glare of a powerful light would seem to indicate poor visual powers, but the eye of *S. maculicaudus* is in nowise degenerate, being as well developed as in the closely related *S. longicaudus*, a species almost entirely epigeal. In this respect it differs from all other salamanders known to be true cave dwellers. *Typhlotriton spelæus* of southwestern Missouri has eyes well developed when young, but somewhat degenerate when adult, while *Typhlomolge rathbuni* of the subterranean streams of Texas has exceedingly degenerate eyes, surpassing in this respect even the renowned *Proteus* of Europe.

Returning now to the subject of our sketch, we will continue the discussion of the habits of the adult *S. maculicaudus*. It is not aquatic to any extent; two or three specimens only have been found in shallow water during our collecting. In captivity, where choice is afforded, it always prefers to remain in a damp place whether remote from or near the water, rather than in that element itself.

#### DEVELOPMENT.

In the breeding season, however, individuals of this species resort to pools of water to deposit their eggs. The process of mating has not been observed nor have the eggs been seen. The larvæ have first been found about February 5, and are at this time slightly under 18 mm. in length. Assuming *Spelerpes maculicaudus* to have about the same rate of growth as some common salamander with which we are familiar, for instance, *Amblystoma opacum*, these larvæ are about one month old. This granted, it follows that the eggs are laid in the early part of January. Small larvæ have been found as late as March 20, indicating a later period of oviposition, but there is no doubt that in Mayfield's Cave the bulk of the eggs of this species are laid at the earlier date.

At 17.5 mm. the larvæ are fairly active. They have a full complement of digits showing that the first larval stages are rapid, and that perfection in larval form is reached comparatively early. The attainment of larger size is, however, a slower process. Twenty-five millimeters is probably the average maximum size reached the first spring. Up to this time the larvæ are fairly uniform in size, but by the succeeding autumn there is a great disparity to be noticed. Larvæ measuring from 31 to 56.5 mm. have been taken in autumn, and some transform at this season. Most of them, however, mature later, twelve to fifteen months after their appearance in the cave.

There is evidence that even a longer period may be passed in the larval state by some individuals, and a longer period than the above seems to be the rule for another member of the genus, *Spelerpes bilineatus*. Concerning this species Wilder<sup>a</sup> says: "The larvæ \* \* \* hatch early and continue for a long time in the larval state, probably 2-3 years. \* \* \* The growth must be exceedingly slow and dependent upon the fortune of the individual in securing prey. I have caught all stages from 16-52 mm. at all seasons of the year, and see no indication that those larvæ collected at any one time represent one, two, or three years of definite growth." That slow development is the rule in the genus is further shown by the life history of *Spelerpes ruber*. Small and large larvæ and recently transformed individuals are commonly found together in the same spring.

The small larvæ of *S. maculicaudus* are easily studied in their native pools. They are most often found lying quietly on the bottom, in their position and distribution reminding one of the johnny darters on the creek bed. But the analogy can be carried no further; the darters are the incarnation of irritability and activity, while no mechanical disturbance short of actual poking will cause these larvæ to move. When captured at the first trial the feat seems easy, but when that fails the larvæ are elusive, and by stirring up the sediment cloud the water so that their motions are not easily followed. Their habit of lying openly on the bottom is changed when they are confined in a well-lighted vessel. Here they seem ill at ease except when hiding under some object on the bottom. When disturbed, they swim rapidly, but not for any length of time, as they soon seek the bottom and nose about for a hiding place. This sensitiveness to light agrees with their behavior in the cave. All larvæ are very much more responsive to light stimulus than the adults, the young larvæ more so than the older. The former always swim away from the source of light, while the latter act in a more uncertain way, lowering and raising the head, starting away but stopping immediately only to lower the head and start in another direction. A light held steadily upon them, however, will cause more decided action, a slow movement away from the light resulting.

In the very oldest larval stages they are also stimulated by light. A large larva found March 4 seemed annoyed by the light, especially when it was flashed suddenly on and off. This larva was approaching transformation. The gills were quite small, the tail had lost some of its keel, and in the shape of both body and head it resembled an adult. Besides these changes, the larval coloration, while not yet lost, was supplemented by the characteristic spots of the adult. Other habits of larvæ at this stage are of interest and are best known to us from the study of specimens in the laboratory.

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<sup>a</sup>Am. Nat., XXXIII, 1899, p. 242.

A larva about 45 mm. long was collected in the cave March 15. It showed no signs of transformation and for a long time was content to stay in the water, resting much of the time upon the lower end of a piece of wood placed at such a slant that the larva had choice of varying depths of water. About April 20, more than a month after being brought from the cave, it began resting nearer the surface and remained often with the nose slightly out of water. When disturbed, it dashed to the bottom, but immediately tried to dart up the sides of the jar and get its nose out again. It kept constantly on the move until it again rested in its favorite position on the piece of wood. About May 1 the young salamander began to spend all of its time either on the wood or the side of the jar, with all or nearly all of its body out of the water. At this time its gills had disappeared; they had begun to reduce ten days before. Soon after transformation it escaped from the jar through a slight crevice in the cover. During its period of indoor life it obtained little food and consequently made no growth. This apparently did not retard transformation, which came with a rush, the final changes of form and color seeming almost to occur in a day. At the time this larva escaped it had no tinge of the orange so conspicuous in the adult, although in all other respects it was a perfect miniature of the full grown salamander.

A more detailed account of the final and most interesting stages of larval life is the history of a larva taken among some stones in water December 21. It was 54 mm. long when captured, and showed no signs of transformation. This larva was well fed with small annelids and occasionally bits of meat. Until January 20 it lived contentedly in the water, but on that date it climbed up on a floating mass of water-cress and remained with the nose and part of the upper surface of the head out of water. On January 23 more of the head was projected, but only part of the time was spent in this position. During the remainder it rested on the bottom, usually under cover. On January 26 the gills were noticeably smaller, and on the next day, at 10 o'clock in the morning, the larva was seen on the side of the jar with all of the head and most of the gills out of water. An hour later it had climbed up farther, and was almost clear of the water. It was breathing air, the throat throbbing rapidly. In the afternoon it left the water completely, but turned and remained for some time with the nose thrust in the water, later remaining in a similar position, but wholly out of the water. The larva was now 57 mm. in length and its gills were less than one-fifth their original size. When disturbed, it jumped down and swam frantically about in the aquarium, stopping under the water-cress, but soon crawled up the side until only the tip of the tail dipped in the water. By January 30 it remained out of water all the time, the gills having entirely disappeared. It was, however, able to remain under water for several

minutes, in one instance fifteen, and often chose to stay under water in daytime, remaining under cover. But most of the day it remained above water and at night seemed to do so entirely.

The changes in the size of the gills preceding transformation are the reverse of stages which are passed through during early larval life. These exclusively larval organs are very slightly developed in the young below 18 mm. in length. In a specimen 17.5 mm. (March 20) and in one 18 mm. (February 16) they are very stubby, with short filaments. At 21 mm. (February 16) the filaments are much lengthened, and a corresponding increase is to be noted in larvæ 36 mm. long (November 12). Up to this stage the distal half of the gill is clear and translucent, while the basal part is pigmented. At 48 mm. (September 30) some specimens show a reduction of the gills, but among specimens having them most perfectly developed is one 50 mm. in length (October 7). In these larvæ the gills are pigmented to some extent even on the delicate filaments. Absorption of the gills probably takes place in most cases when the larvæ are between 50 and 55 mm. But we have one larva 56.5 mm. long (October 28) in which the gills are perfect, although this specimen is longer than many of the recently transformed adults. The state of the gills, however, shows that it is a genuine larval form, and although we have observed one longer specimen (57 mm.) with gills reduced and near transformation, it seems certain that the growth of this individual was accomplished under the most favorable conditions and that in it are realized the utmost possibilities of larval development under natural conditions.

The process of absorption of the gills is the reverse of that of growth, in detail as well as in entirety. Whereas the basal stubs are present in early life and from them are budded out the filaments, the latter are the first parts absorbed, the main arches disappearing slowly. After this is completed the place of joining of the edges of the gill-slit is indicated for some time in the young adults by a dark line, which is visible on both the dorsal and ventral surfaces of the side of the neck. Besides the changes in these particular organs of the transforming larvæ the entire body seems to lose in bulk, becoming flattened and undergoing a special reduction in vertical dimension in the tail, which loses all traces of the keel. Further, the neck appears longer and slimmer, making the head more conspicuous, and, finally, the eyes become much more prominent.

The evolution of form is accompanied by as great a change in color. To the naked eye the young larvæ appear uniformly gray, while the adult is flaming orange with conspicuous black spots. The study of the development of the color pattern is of so much importance as an aid in identifying the larval salamanders (a thing still impossible in the case of many common species) that it has been separated from the main account of the life history and treated in greater detail.

DEVELOPMENT OF THE COLOR PATTERN IN THE LARVÆ OF  
*SPELERPES MACULICAUDUS*.

By WALDO L. MCATEE.

The youngest larvæ of the species are nearly uniformly pigmented, while the adults are marked with separate, sharply defined spots. The development of the color pattern, therefore, is the change from even distribution of pigment cells on the smaller animal to their concentration in restricted areas on the larger.

At 17.5 mm. (fig. 1, Plates VIII and IX) the pigment<sup>a</sup> cells are abundant and about evenly distributed over the whole body, with the exception of certain invariably pigmentless areas which form the most conspicuous and characteristic feature of the larval coloration. The least important of these (that is, the one which for all practical purposes is identical in adult and larva) is the ventral area and its history may as well be completed at once. This ventral area extends from the gular fold or from slightly in front of it to the cloaca, often being prolonged in a narrow line on the tail, and includes the inner surfaces of the limbs with which it may or may not be connected. It is generally bridged by a band of pigment cells over the pubic region and in cases where it extends anterior to the gular fold, by a narrower band along the gill slits. In younger larvæ the latter condition exists, as the lower surface of the head is not so completely pigmented as in older larvæ and adults. In the later larval stages the anterior bridge of pigment may separate in the median line or it may persist, leaving thus a small separate pigmentless area. In the adult, however, the head is entirely pigmented on the underside back to the gular fold.

In larvæ above 30 mm. in length the ventral area is liable to be encroached upon by pigment in various places, but the middle line at least remains spotless until transformation. In the adult, while the lower side of the tail loses the marbling which it generally possesses in the larva, it retains some pigment; in fact there is no considerable area on any part of the body free from pigment dots. The dots can be made out with close scrutiny by the unaided eye, but are more easily studied with a lens.

Thus while the presence of pigment cells over the whole ventral surface is exclusively an adult character of the species, and demands consideration in a discussion of the development of the color pattern, this area, with the exception of the lower surface of the head, may, for the purpose of ordinary description, as before mentioned, be considered immaculate in the adult as it actually is in the larva.

The other conspicuous pigmentless areas of the larva are arranged in three longitudinal series on each side, and together with the pigment around them play the major part in the evolution of the color pattern.

<sup>a</sup> The term pigment as used here refers to the apparently black color spots only.

These areas are roughly circular to oblong, and are most prominently developed between the levels of the root of the fore limb and of the cloaca, although each series may be traced more or less distinctly on both the head and tail. Counting from the insertion of the fore leg to the region which may be overlapped by the hind one, there are in the upper (first) series of areas about ten, in the middle or second series, thirteen to fifteen, and in the lowest or third series from seven to thirteen.

The upper series is near the mid-dorsal line and in larvæ from 17.5 to 21 mm. (fig. 2, Plates VIII and IX), is the most conspicuous of the three, being made up of the largest areas. This series is first to disappear in the development of the color pattern. The second series is situated just above the middle of the side, being visible from above. It is the longest lived of the series, sometimes remaining quite perfect after transformation. The third and lowest series begins under the fore leg and extends along the side toward the hind leg, sometimes falling short of that point, sometimes surpassing it. This series is the most variable and is not of much importance in the production of the adult coloration. It is none the less an important larval character. In some salamanders, notably various species of *Amblystoma*, this series exhibits metallic color.

Returning now to the smallest of the larval stages (17.5 mm.) we will trace the fate of the pigmentless areas and also of the abundant pigment cells so uniformly covering the surface of the larvæ of this age. Besides the above-mentioned conspicuous immaculate areas, the interstices of the pigment spots form a reticulation over the whole body, which with the former makes the ground color of the larva. In the stage at present under discussion this is light yellow.<sup>a</sup>

The ventral area in this as well as succeeding stages is pale. The legs are covered above with a coarse network of pigment, generally with an open space over the base of the toes, which is also a persistent character in the larva. The particular feature to be noticed about this larva, however, is the uniformity of coloration, especially of the dorsal surface (fig. 1, Plate IX). At 21 mm. (fig. 2, Plates VIII and IX), the principal differences to be noted are those due to growth. As a result the only change in color is a general paling, due to the widening of the spaces between the pigment spots. It is possible that this is just a little more conspicuous in the area between the mid-dorsal line and the first series of larval spots, beginning the most important change of the next stage.

At 31 mm. (not figured), the pigment on the dorsal surface on either side of the mid-dorsal line begins to collect, forming nuclei for the future spots. In this first stage of analysis the mid-dorsal region retains its reticulated pigmentation. The 36.5 mm. larva (fig. 3, Plates

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<sup>a</sup> In formalin.

VIII and IX) shows the same process; the migration of pigment cells from the borders of the upper series of larval areas, destroying them as such, and merging them into the now lightly pigmented dorso-lateral areas. The pigment on the head shows a tendency to concentrate, making this part of the dorsal surface lighter. At this stage the ground color is clear yellow. The second and third series of larval areas, and the pigment spots of the legs and tail, maintain their previous arrangement.

When the larva is 48 mm. in length (Fig. 4, Plates VIII and IX), the lightness of the dorsal area is emphasized, most of the primary pigment reticulum having aggregated into the now distinct spots. The spots on top of the head are further intensified, reaching a stage of development in which they remain until or after transformation. The pigment-cells move away from areas on both the lower and upper parts of the tail at the base of the keel, marking the proportion of this that will be absorbed and forming for the tail dorso-lateral areas similar to those shown in the last stage on the dorsal surface of the body proper.

The pigment blotches on the legs and on the side of tail, head, and body are more widely separated, but the lower two rows of larval areas remain intact. The ground color is possibly a shade more yellowish at this stage.

The principal change in the next stage (51.7 mm., fig. 5, Plates VIII and IX) is the further development of the dorsal spots. They are probably as conspicuous in the specimens figured as they ever are before transformation. From the same figures it will be seen that all the other features are about the same as in the preceding stage and that the pattern of the legs and the second and third series of larval areas are in practically the same condition as in the 17.5 mm. larva.

However the ventral fin of the tail has been absorbed and nearly all of the pigment-cells have migrated from the dorsal keel and are collected with the rest in a dense reticulation over the surface of what will be the adult tail. The cells remaining in the keel later form the few spots that exist on the mid-dorsal line of the tail in the adult. In all larvæ 50 mm. or more in length the ground color has deepened and is noticeably yellow.

The changes in form of the body at transformation are much greater than those in its color, but the latter are important. In a specimen 55 mm. long representing the most recently transformed stage we have (Fig. 6, Plates VIII and IX) the ground color can scarcely have changed from that of the last stage, but the dorsal spots of both body and tail have attained the perfect size and definition. The color pattern of the head and legs remains about as in the last stage. Both the second and third series of pigmentless areas are breaking up, however, anastomosing with each other and with the adjoining lighter

areas. The pigment forming the lower border of the first series and the upper margin of the second now collects into the most conspicuous series of spots on the lateral surface. The pigment on the sides of the tail is also beginning to form spots.

It is possible that stages of the various components of the color pattern presented by this specimen may be omitted by some at transformation, and on the other hand they may be prolonged, in other cases for some time afterward. *Spelerpes bilineatus* seems especially liable to such vagaries at transformation, and this suggests the possibility of a parallel case in the present species. However, the larva is undoubtedly intermediate in age between the preceding and succeeding examples making the color stage valid for our series if it is not for every one.

The next stage (55.5 mm. fig. 7, Plates VIII and IX) is a typical newly-transformed cave salamander. The ground color is lemon yellow, the spots are distinct with but few traces of the primitive pigment reticulation. The pigment on the legs is now for the first time collected in spots. The head is more plainly spotted, approaching nearly to the adult condition. The spotting on the sides of the tail is definite though not yet perfect, and of the series of immaculate larval areas only one, the second, is traceable. On each side of this series of clear areas the bands of pigment cells are collected into dense bars, which now break up to form two rows of spots, which are very conspicuous in the adult salamander. The third and lowest series of larval areas is no longer present. The nebulous pigment surrounding them forms irregularly distributed blotches on the lower sides of the salamander and contributes many cells to the ventral area, which now becomes entirely, if sparsely, pigmented. In a salamander of this age, with the second series of larval areas almost intact, the original position of the three series of clear areas and the fate of their accompanying pigment masses is not difficult to trace. But in the fully grown adult, at first blush, it does not appear that the grouping of the blotches is the result of even a fairly definite system. The influence of their origin upon their arrangement becomes apparent at once, however, when compared with newly transformed specimens, such as the one just described.

The scattered pigment cells at this stage are more abundant than in the full grown adult, and the pigment blotches less distinct. As the animal grows the scattered pigment collects more and more in the blotches, which grow larger and at the same time more dense. Stages in this aggregative process may be seen about the edges of the blotches on any adult. Approaching and newly united pigment cells form a fringe about most of them.

Few other changes occur in the pigment beyond the stage just described (55.5 mm.). In many adults the chaining of blotches along

the sides gives way to separate spots (Fig. 2, Plate X), but this is not an essential change as some specimens show a nearly continuous bar from back of the eye to the middle of the tail. The ground color, however, gradually deepens, becoming vermillion in highly colored specimens.

The development of the color pattern may be summed up as follows: Originally pigment cells are evenly distributed except for a ventral and three lateral series of pigmentless areas. In later development these acquire pigment by influx from adjoining parts thus causing a dilution of pigment. Otherwise the keynote of the entire process is concentration.

The pigment of the head, legs, and tail moves little, simply crowding together in blotches. The concentration of the pigment cells of the tail presents one notable feature, namely, that a few cells remaining in the keel are laid down as median spots when that portion is absorbed, forming the only noticeable group of so located spots on any part of the animal.

The movements of pigment cells on the body proper are more complex. The spots on the dorsal surface are formed of pigment from the immediate vicinity and also from the border of the upper series of immaculate areas. The fact that the first spots originating here are lateral probably accounts for the scarcity of true median spots. The large amount of pigment paralleling the second series of pigmentless areas on each side collects into the two series of distinct blotches on the side of the adult. The pigment of the third series forms many small scattered spots on the flanks of the adult and contributes to the pigmentation of the ventral area.

While in the development of the pigment pattern there seems to be no increase in the number of cells, the change of the ground color from buff to orange and vermillion is accomplished wholly by the addition of coloring matter.

#### MELANISTIC SPECIMENS.

A point that arises in connection with the matter of the addition of pigment is whether the so-called melanistic specimens really have an extra amount of pigment, or whether their peculiar coloration may not be explained in another way. Dr. C. H. Eigenmann gives an account of two specimens of the cave salamander which have more than the usual proportion of the surface pigmented. In one from Rock House Cave, Missouri, there is a lateral streak "broad enough to cover the sides with a mottled pattern." Another specimen among twelve from Marble Cave, Missouri, is described at length:<sup>a</sup>

The lower surface of the head is more densely pigmented than in the other specimens. The sides are more uniformly pigmented than in the melanistic individual from Rock House. The sides of the head, body, the arms, and anterior surface of

<sup>a</sup>Biological Bulletin, IV, 1903, pp. 227-8, fig. 1.

the legs are uniformly pigmented, except a few small blotches or spots. The pigmentation is not as intense as in the dorsal spots. The most striking deviation is found on the dorsal surface. The usual spots are present, rather smaller than in the other specimens. The intervening spaces are more densely covered with pigment cells than in the normal specimens, and in several places, notably the head, the nape, and one or two places on the back, the spots seem to have "run," their closely compact pigment cells having been distributed in a thinner coat over a wider area and form, with the similarly distributed pigment of other spots, diffuse, evenly pigmented blotches. In life the specimen suggested that the inhibitory force which kept these color cells from spreading, or the positive tropism which kept them together, was dissolved and the cells scattered evenly in a single layer over the surrounding region. The centers of distribution are still distinguishable as darker areas at the margin of or in the blotches.

The "centers of distribution" are more probably the original spots where the collection of pigment began. In fact all points in con-



FIG. 2.—MELANISTIC SPELERPES MACULICAUDUS. (DORSAL VIEW.)

nection with these specimens suggest that they represent, not modified adult stages but inhibited larval conditions. The lateral color pattern of the Marble Cave specimen, as shown by the figure (fig. 3), could be easily produced by the cessation of pigment aggregation at the stage represented by fig. 5, Plates VIII and IX (51.7 mm.), plus the uniform distribution of isolated pigment cells over the clear lateral areas, which process always occurs in the ordinary adult. On the dorsal surface there are not many spots, indicating that a few of the earliest centers attracted all the pigment. The diffuse condition of these blotches and

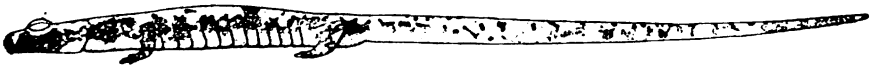


FIG. 3.—MELANISTIC SPELERPES MACULICAUDUS. (LATERAL VIEW.)

the connection of many of them with the lateral pigment band is a further indication of the cessation of concentration at some larval stage. The Rock House Cave specimen with its mottled pattern on the sides is probably almost a copy, as far as coloration goes, of the larval stage to which we have just referred.

#### IDENTIFICATION OF LARVÆ.

Now that we have considered in detail the color pattern of the larvæ of *Spelerpes maculicaudus*, and have many characters to identify them as such, it will be of interest to know how they may be distinguished from larvæ of other species with which they may be associated.

*Spelerpes* larvæ may be easily separated from those of *Amblystoma* by their more slender form. The latter always have broad heads,

their general appearance in the water suggesting a small catfish. Larvæ of *Diemyctylus* are maculate at an early age, have a dark line through the eye, and when of fair size show the red lateral spots, all of which characters the larvæ of the cave salamander lack. In one larva of the newt examined, the upper series of larval areas is 6 in number, the middle, 12, and the lower series obsolete. *Desmognathus* larvæ are characterized by an upper series of 10 to 11 large clear areas which are distinctly dorsal in position and run together on the tail. (The number given includes only those anterior to the point of union.) As this series of areas is distinctly lateral in *maculicaudus*, the separation of the larvæ of these two species will not be difficult.

In the genus *Spelerpes* itself, the differentiation is as easy in the case of the species we have studied. Not a sufficient number of *longicaudus* larvæ have been seen to warrant a definition. This is particularly unfortunate, as there is no doubt that it is most closely related to the present species. In one large larva of *longicaudus* the upper series of clear areas had disappeared, the middle one had about 16 to 18 spots, and the lowest series 12. If these numbers are constant they furnish a means of distinguishing these nearly related larvæ. In larvæ of *longicaudus* that have attained fair size the vertical bars on the tail are apparent, thus making this character available for identifying larvæ as well as adults.

Only large larvæ of *guttolineatus* have been seen. These are conspicuously marked. In the upper series of clear areas there are four, and the middle and lower series form continuous light bands on the sides of the animal. The belly is longitudinally striped, this character serving to separate these larvæ from any others of the genus here considered.

The young larvæ of *bilineatus* have the upper series of larval areas very conspicuous and the lower two series not evident. The upper of these is developed to some extent later. Also *bilineatus* larvæ have the dorsal area light in very early as well as later stages, and there are never as many nor as prominent blotches on it as in *maculicaudus*. *Spelerpes ruber* is easily distinguished in all stages. The older larvæ are, up to the time of transformation, almost uniformly vermiculated with pigment, while the young larvæ, in addition to practical uniformity of color, have a decided character in the great number of areas in the middle series, namely, 28. These resemble the stitching of a sewing machine, so close together are they, and appear as a finely dotted line on the side of the larvæ. In this series it will be remembered *maculicaudus* has only 13 to 15. These series of immaculate areas on the side of the larval salamanders seem to form a good character for the determination of species. Therefore we offer tentatively a table embodying the results of the study of a few species as a further aid in distinguishing the larvæ of the cave salamander.

Tabulation of the immaculate areas on the sides of larval salamanders.

| Name.                                | Upper row.            | Middle row.              | Lower row.  |
|--------------------------------------|-----------------------|--------------------------|-------------|
| <i>Spelerpes maculicaudus</i> .....  | 10                    | 13-15                    | 7-13        |
| <i>Spelerpes bilineatus</i> .....    | 14                    | <sup>a</sup> indistinct. | indistinct. |
| <i>Spelerpes ruber</i> .....         | 13                    | 28                       | do.         |
| <i>Spelerpes longicaudus</i> .....   | <sup>b</sup> unknown. | 16-18                    | 12          |
| <i>Spelerpes guttolineatus</i> ..... | <sup>c</sup> 4        | continuous.              | continuous. |
| <i>Diemyctylus viridescens</i> ..... | <sup>d</sup> 6        | 12                       | indistinct. |
| <i>Dermognathus fuscus</i> .....     | 10-11                 | 11                       | 10          |
| <i>Amblystoma opacum</i> .....       | 5                     | 9                        | 12          |

<sup>a</sup> See notes above.<sup>b</sup> Only 1 large larva at hand.<sup>c</sup> Only large larvæ seen.<sup>d</sup> Only one specimen examined.

Using the table in connection with the remarks above there should be no difficulty in separating the species treated.

#### SYNOPSIS OF THE PRINTED RECORDS OF THE OCCURRENCE OF SPELERPES MACULICAUDUS.

##### Indiana:

Brookville, Franklin County.  
 Northeastern Franklin County.  
 Decatur County.  
 Westport, Decatur County.  
 Monroe County.  
 Bloomington, Monroe County.  
 May's Cave.  
 Vincennes, Knox County.  
 Indian Springs, Martin County.  
 Porter's Cave, Owen County.  
 Donnehue's Cave, Lawrence County.  
 Donnelson's Cave, Lawrence County.  
 Kern's Cave, Lawrence County.  
 Clifty Cave, Washington County.  
 Wyandotte Cave, Crawford County.  
 Little Wyandotte Cave, Crawford County.  
 Small cave near Wyandotte, Crawford County.  
 Marengo Cave, Crawford County.  
 Saltpeter Cave, Crawford County.  
 Sibert's Well Cave, Crawford County.

##### Missouri:

Barry County.  
 Rockhouse Cave.  
 Wilson's Cave.  
 Marble Cave.

## ADDITIONAL RECORDS.

Besides the stations given above, the following localities are represented by specimens in the United States National Museum: Barger's Spring, near Hinton, West Virginia; Union County and Winehouse Cave, Tennessee; Mammoth Cave, Kentucky, and Jefferson County, Missouri. The following localities may now be added to the Indiana list: Mayfield's and Truitt's caves, Stony and Leonard's springs and Griffey Creek, Monroe County; and Twin Caves, Lawrence County.

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## EXPLANATION OF PLATES.

## PLATE VIII.

*Spelerpes maculicaudus* (Cope).

- Fig. 1. Larva, 17.5 mm. long x 4. Lateral view.
2. Larva, 21 mm. long x 4. Lateral view.
3. Larva, 36.5 mm. long x 2. Lateral view.
4. Larva, 48 mm. long x 2. Lateral view.
5. Larva, 51.7 mm. long x 2. Lateral view.
6. Young adult, 55 mm. long x 2. Lateral view.
7. Young adult, 55.5 mm. long x 2. Lateral view.

## PLATE IX.

*Spelerpes maculicaudus* (Cope).

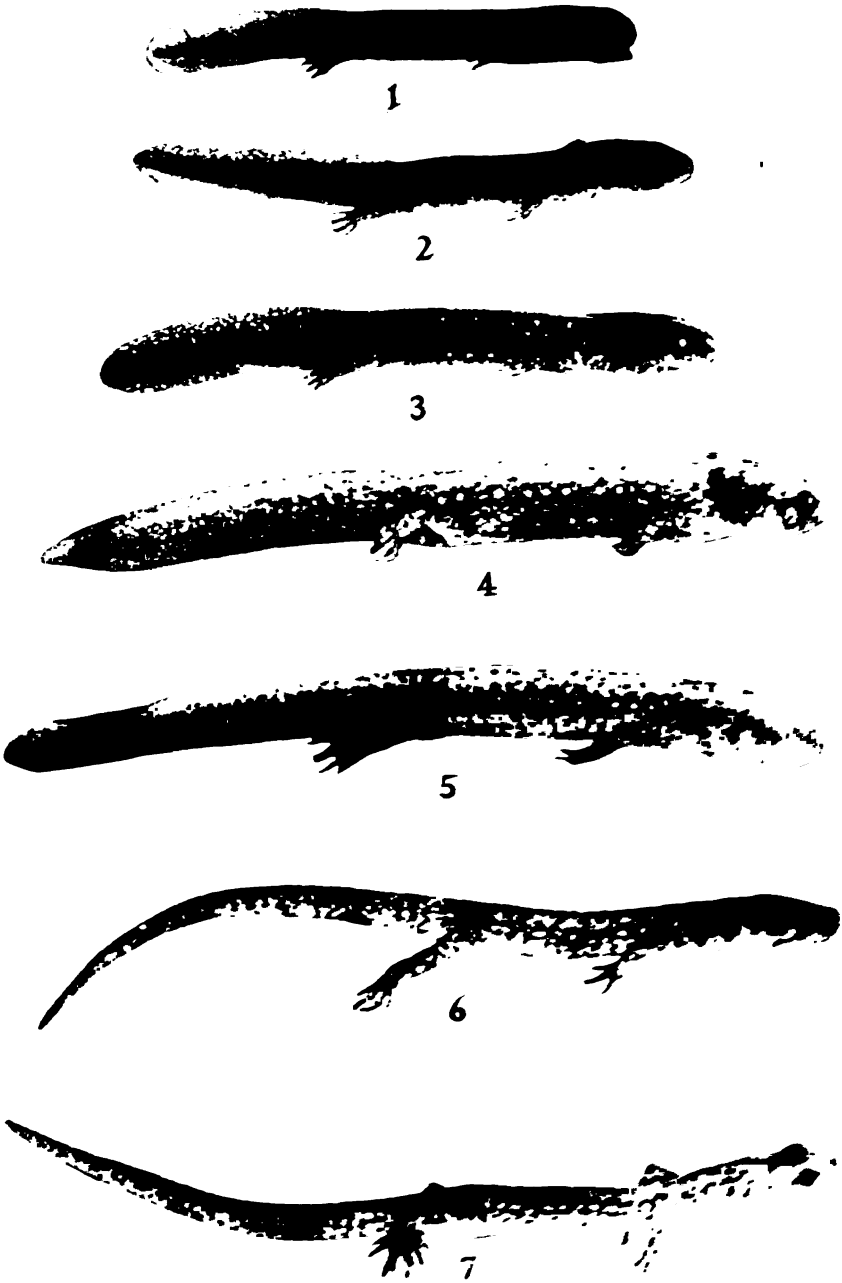
- Fig. 1. Larva, 17.5 mm. long x 4. Dorsal view.  
2. Larva, 21 mm. long x 4. Dorsal view.  
3. Larva, 36.5 mm. long x 2. Dorsal view.  
4. Larva, 48 mm. long x 2. Dorsal view.  
5. Larva, 51.7 mm. long x 2. Dorsal view.  
6. Young adult, 55 mm. long x 2. Dorsal view.  
7. Young adult, 55.5 mm. long x 2. Dorsal view.

## PLATE X.

*Spelerpes maculicaudus* (Cope).

- Fig. 1. Half-grown adult, 88 mm. long x 2. Dorsal view.  
2. Half-grown adult, 88 mm. long x 2. Lateral view.





LARVAE AND YOUNG ADULTS OF *SPLETTER MACULATUS*  
FOR EXPLANATION OF PLATE SEE PLATE XX





LARVÆ AND YOUNG ADULTS OF *SPELERPES MACULICAUDUS*.

FOR EXPLANATION OF PLATE SEE PAGE 83.





ADULT OF SPELERPES MACULICAUDUS.

FOR EXPLANATION OF PLATE SEE PAGE 83.



## DESCRIPTIONS OF NEW SOUTH AMERICAN MOTHS.

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By WILLIAM SCHAUS,  
*Of Twickenham, England.*

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The following paper is a continuation of one presented by me in these Proceedings, XXIX, 1905, pp. 179-345. (No. 1420.) One hundred and fifty-one species are described here.

### Family CITHERONIDÆ.

#### Genus ARSENURA Duncan.

#### ARSENURA BIUNDULATA, new species.

Body brown. Primaries: the costal margin dull gray, irrorate on basal third with dark brown; cell and beyond to postmedial line buff, irrorate with black and brown; a broad blackish-brown streak on discocellular; antemedial line inwardly oblique from subcostal to median, then outwardly curved, blackish brown, inwardly shaded with buff; below cell to inner margin brown, also between postmedial and subterminal lines; the postmedial reddish, slightly incurved below vein 2; the subterminal whitish, inwardly edged with black, forming a deep outward curve at vein 7 and outward curves above and below vein 3, followed by a black shade irrorated with pale-blue scales, forming projecting markings above and below vein 5, and partly followed by whitish from below vein 4 to inner margin; the black shades are interrupted from vein 6 to below costa, where there is a large black spot, and replaced by a gray shade edged with white lines; some dark-red shades above and below vein 6; apex roseate; outer margin otherwise dull olivaceous brown. Secondaries: basal half light brown, with very long scales partly dark brown; outer part to subterminal clear dark brown; the subterminal white, slightly angled above and below vein 3, followed by a brown shade; a black shade outwardly toothed and irrorate with pale-blue scales; outer margin light brown, with thick dark-brown lunular spot. Underneath grayish buff, irrorated

with brown; dark streaks on the discocellulars; a dark-brown outer line; the postmedial more buff-white, with only traces of black shades.

*Expanse*.—150 mm.

*Habitat*.—Rio Grande do Sul, Brazil.

Some males are smaller than the type specimen, and the female is considerably larger.

*Type*.—Cat. No. 9451, U.S.N.M.

**ARSENURA DRUCEI, new species.**

Body brown, the thorax tinged with gray. Primaries: costa to postmedial line dark gray, thinly irrorated with black; a grayish buff shade below subcostal also irrorate with black; otherwise brown, more reddish brown between postmedial and subterminal; inner margin grayish brown; a vague dark-gray streak on discocellular; postmedial dark brown, slightly wavy, fine, black, outcurved at vein 7, then finely wavy, followed by white between veins 4 and 5 and by smaller white spots at veins 3, 2, and below vein 2; from below vein 4 an irregular blackish shade to inner margin, crossed by a bluish-white line; a broad lilacine gray space from vein 6 to costal margin, outwardly indentate at vein 7 and edged by a fine white line, terminating in a small black spot on costa, partly followed by a reddish shade. Secondaries grayish brown to outer line, then dark brown to subterminal, which is whitish, finely wavy, and followed by a blackish line, thickening between the veins. Underneath lilacine buff, irrorated with black; black spots on discocellulars; a fine dark-brown outer line; the postmedial lunular, wavy, consisting of a geminate line of lilacine scales, the outer margins olive brown without irrorations.

*Expanse*.—Female, 145 mm.

*Habitat*.—Chiriqui, Panama.

This species is figured<sup>a</sup> as the female of *C. arcae* Druce, of which I have both sexes. The two species are quite different underneath.

*Type*.—Cat. No. 9452, U.S.N.M.

**ARSENURA THOMSONI, new species.**

Body buff, the thorax tinged with grayish brown. Primaries, light brown, strongly shaded with gray at base and above median and vein 2 to near the outer line, this grayish portion irrorated with black; faint traces of an antemedial brownish line; discocellular edged with brown; the outer line fine, blackish brown, nearly straight from vein 6 to inner margin, outwardly shaded with white between veins 4 and 5 and between 2 and submedian, otherwise followed by large patches of iridescent steel-gray; above vein 6 the line continues straight to costa as a grayish shade, followed by a lilacine gray space outwardly edged by a fine white line, deeply indentate on vein 7, and by black points

<sup>a</sup> Biologia Centrali-Americana, pl. xix, fig. 3.

at vein 8 and white lines above and below vein 8 from this point to apex; a reddish brown streak from below vein 6 to outer margin at vein 7. Secondaries, pale brown; the long hairs on basal portion tinged with gray; a darker brown postmedial shade followed by a blackish gray shade; a subterminal iridescent steel-gray shade, outwardly lunular, and crossed by a vague paler line. The wing is much prolonged below vein 5. Underneath pale gray, thinly irrorated with blackish striae; dark brown streaks on discucellulars; some marginal lunular whitish shades, followed on secondaries by paired pale reddish brown streaks at veins; a dark gray outer shade on primaries.

*Expanse*.—Male, 152 mm.

*Habitat*.—Omai, British Guiana.

Named after Mr. S. A. Thomson, to whom I am indebted for this fine species.

*Type*.—Cat. No. 9453, U.S.N.M.

**ARSENURA SAMBA, new species.**

Primaries: outer margin strongly crenulate, produced at vein 6; dark brown, whitish violaceous washed to terminal fourth; darker at base with a different obsolete line and white hair on inner margin sub-basally; inner line straight, dark, diffused, faintly edged with whitish inwardly; a mesial line slightly curved, crossing end of cell and touching outer line at submedian fold; outer line from costa at outer third, with a diffuse white costal blotch before and after its inception, dark, at vein 4, joining the dark marginal shade and thence forming its inner border, separated below by a few white scales. Secondaries: outer margin produced into a long tail; dark brown, a faint darker straight mesial band with a few scattered, gray scales beyond; inner half of wing toward base densely haired. Below dark brown, a large patch of brownish white on margin at end of vein 7 and a smaller one below vein 6, both irrorated with brown.

*Expanse*.—100 mm.

*Habitat*.—Omai, British Guiana.

*Type*.—Cat. No. 9454, U.S.N.M.

**Genus AUTOMERIS Hübner.**

**AUTOMERIS MERIDANA, new species.**

Head and thorax pale olivaceous brown. Abdomen crimson above, underneath and anal hairs buff-brown. Primaries pale buff-brown irrorate with olivaceous scales; antemedial line wavy, ocherous; a quadrate dark gray space at end of cell, with a few black points on its edge; an outer blackish line from costa near apex to inner margin beyond middle, inwardly edged with ocherous below vein 6. Secondaries: the costal and outer margins buff-gray; inner margin broadly reddish; otherwise deep yellow to the black outer line, which is finely wavy;

the ocellus dark brown, edged with black and containing a white spot; the black outer line followed by a broad violaceous brown shade. Underneath brownish buff. Primaries: a large black spot at end of cell containing a white spot; an outer dentate blackish shade. Secondaries: a white point on discocellular.

*Expanse*.—Male, 60 mm.

*Habitat*.—Merida, Venezuela.

*Type*.—Cat. No. 9455, U.S.N.M.

**AUTOMERIS VOMONA, new species.**

*Male*.—Head and thorax light brown. Abdomen black above with transverse reddish lines posteriorly on the segments. Primaries pale pinkish brown; antemedial line very indistinct and irregular; the outer line slightly sinuous from costa close to apex to middle of inner margin, dark gray-brown, inwardly edged with ochereous; a reddish-brown space at end of cell surrounded by a few black points. Secondaries pale yellow; the costal and outer margins roseate brown; the base and inner margin broadly red; the ocellus dark brown, broadly edged with black and containing a white spot; the yellow space limited by a black evenly-curved line, followed by a subterminal reddish shade.

*Female*.—The primaries are bright reddish brown, the outer line broadly edged inwardly with white.

*Expanse*.—Male, 71 mm.; female, 90 mm.

*Habitat*.—Merida, Venezuela.

*Type*.—Cat. No. 9456, U.S.N.M.

**AUTOMERIS ANNULATA, new species.**

*Male*.—Body above dark olive brown, the abdomen with whitish transverse lines posteriorly. Primaries olivaceous brown to outer line, then buff-gray; a fine brown antemedial line, oblique from costa to median, then wavy to inner margin; a dark annular line at end of cell, and a dark point within it; the outer line dark brown, from apex to middle of inner margin. Secondaries: the costal and outer margins broadly gray; the inner margin broadly olive brown; discal space bright yellow, limited by a slightly wavy black line; a broad subterminal brown shade; the ocellus blackish brown, broadly circled with black, and containing a few white scales. Underneath buff-gray; a large black spot with white center on primaries.

*Expanse*.—74 mm.

*Habitat*.—Omai, British Guiana.

*Type*.—Cat. No. 9457, U.S.N.M.

**AUTOMERIS INNOXIA, new species.**

Head and thorax dark brown. Abdomen light brown, violaceous red subdorsally. Primaries dark brown, tinged with roseate on outer margin; antemedial line fine, black, wavy; some white atoms at base;

a large darker space at end of cell, indistinctly outlined with black and containing a minute gray point; postmedial line fine, dark, nearly straight from costa at 9 mm. from apex to inner margin. Secondaries violaceous red; the outer margin roseate brown; the ocellus very large, blackish brown, crossed by a white line and broadly circled with black, then narrowly with yellow; it interrupts a black outer line. Underneath light brown. Primaries: the inner margin violaceous red; a very large black spot at end of cell containing a white spot; a minute white spot on discocellular of secondaries.

*Expanse*.—77 mm.

*Habitat*.—Omai, British Guiana.

*Type*.—Cat. No. 9458, U.S.N.M.

**AUTOMERIS POMIFERA, new species.**

Head and thorax brown. Abdomen reddish above, light brown underneath. Primaries brown; some white at base; antemedial line fine, black, very slightly wavy; the dark space at end of cell oval, finely edged with black and containing a white point; postmedial line fine, black, from costa at 7 mm. from apex; a very indistinct darker subterminal shade. Secondaries: the costa, base, inner margin, and subterminal shade reddish; the outer margin light brown; the discal area bright yellow, limited by a black outer line; the ocellus dark brown broadly circled with black, and containing a cluster of black scales crossed by a white line.

*Expanse*.—72 mm.

*Habitat*.—Carabaya, Peru.

*Type*.—Cat. No. 9459, U.S.N.M.

**AUTOMERIS JUCUNDOIDES, new species.**

Head and thorax reddish brown. Abdomen brownish yellow, shaded with pale reddish brown subdorsally at base. Primaries: basal space pale reddish brown; some lilacine at base; median space pale lilacine brown; a blackish space at end of cell; postmedial line fine, pale reddish brown from costa near apex; outer margin light ochereous brown, with a paler subterminal shade. Secondaries pale reddish; the ocellus large, light brown circled with black and then with yellow, containing a few white and gray scales, outer line short. Underneath pale reddish brown, a darker outer line; a large black spot on primaries containing a white point; a minute white and gray spot on secondaries.

*Expanse*.—63 mm.

*Habitat*.—St. Laurent, French Guiana.

*Type*.—Cat. No. 9460, U.S.N.M.

**AUTOMERIS HAMATA**, new species.

Head and thorax dark reddish brown. Abdomen reddish. Primaries ocherous brown in the male, lilacine brown in the female; apices produced and falcate in the male, less so in the female; line dark brown; antemedial line straight to median, inwardly angled at vein 2, then outwardly oblique to middle of inner margin; the medial space slightly darker; a dark streak on discocellular encircled by an irregular dark line; the postmedial from costa at about 9 mm. from apex, then slightly incurved to inner margin, heavily irrorate inwardly with white above vein 6; a paler lunular subterminal shade. Secondaries pale reddish; the outer margin light brown; the ocellus pale lilacine brown, circled with black and containing a small cluster of black and white scales; the outer line fine, wavy, black edged with yellow, broadly in the male, also outwardly in the female.

*Expanse*.—Male, 75 mm.; female, 85 mm.

*Habitat*.—Costa Rica and Venezuela.

*Type*.—Cat. No. 9461, U.S.N.M.

**AUTOMERIS MORESCA**, new species.

*Male*.—Head and thorax dark brown. Abdomen light reddish. Primaries lilacine brown, shaded with buff beyond cell and on outer margin; an irregular darker space at end of cell, edged with dark points; a subterminal dark line, inwardly edged with buff, from costa near apex to inner margin near angle. Secondaries light reddish, the outer margin lilacine brown, the ocellus large, gray-brown, containing a black spot irrorated with white and crossed by a white line, broadly circled with black; the outer line fine, black, slightly wavy, inwardly shaded with yellow, and followed by a reddish-brown shade.

*Expanse*.—78 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9462, U.S.N.M.

**AUTOMERIS PARILIS**, new species.

*Male*.—Head and thorax dark brown. Abdomen reddish. Primaries brownish buff, the lines dark, medially edged with yellow; the antemedial slightly oblique and wavy; a large dark gray space at end of cell, with a few minute black points on its edge; the postmedial from costa at 5 mm. from apex; a pale reddish-brown shade from costa at two-thirds from base to postmedial line at vein 4; a subterminal yellowish-buff shade parallel to postmedial from apex to vein 4, then forming two outward curves to vein 2; beyond this the outer margin is paler. Secondaries pale reddish, the outer margin buff-gray; the ocellus grayish brown, broadly circled with black and containing a round black spot crossed by a white line; the outer line black, slightly wavy,

followed by a violaceous shade. Underneath light brown; a dark outer line; a large black spot on primaries, containing some gray scales; a large white point on secondaries.

*Expanse*.—90 mm.

*Habitat*.—Cayenne, French Guiana.

A female from Trinidad, evidently belonging to this species, has the primaries and outer margin of secondaries lilacine brown.

The species is allied to *A. illustris* Walker.

*Type*.—Cat. No. 9463, U.S.N.M.

#### AUTOMERIS ORODINA, new species.

Head and thorax greenish buff. Abdomen yellow with narrow transverse black bands. Primaries green-buff, the lines fine, blackish; the antemedial straight from costa at 6 mm. from apex; a subterminal grayish shade. Secondaries yellow, the ocellus red, circled with black and containing a pink center, followed by a black band and broad subterminal black band.

*Expanse*.—51 mm.

*Habitat*.—Paraguay.

This species is very much like *A. orodes* Boisduval, but the outer margin of primaries is quite straight.

*Type*.—Cat. No. 9464, U.S.N.M.

#### AUTOMERIS CURVILINEA, new species.

Head and thorax blackish brown. Abdomen above rufous brown, with transverse black bands; underneath dull brown.

*Male*.—Primaries grayish brown, more distinctly brown between postmedial and subterminal; antemedial line black, straight; a clearer brown space at end of cell, with large black spot above and below it; postmedial fine black from costa near apex, forming a deep inward curve to inner margin; a dark brown subterminal shade nearly straight. Secondaries rufous brown; the outer margin gray-brown; the ocellus large, dull brown, broadly circled with black, and containing a few black and white scales, followed by a black line and a narrow brown shade.

*Expanse*.—72 mm.

*Habitat*.—Rio Cocolado, Peru.

Female grayer in tone; the secondaries dark gray, with a few ochreous hairs at base.

*Expanse*.—115 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9465, U.S.N.M.

## Genus PHRICODIA Hübner.

## PHRICODIA BAROMA, new species.

*Male*.—Primaries brown buff, incompletely shaded in blackish, terminated in intravenular rounded arcs at position of subterminal line; a round black discal dot faintly outlined in gray; base red brown, limited by an outwardly oblique white line. Secondaries reddish to the disk, margin buff brown; basal hairs brighter red; discal dot and curved mesial line dark brown, followed by a pinkish space and a broad dark-brown outer band. Underneath the primaries have a mesial whitish shade and dark subterminal band, both faint; secondaries similarly marked, more distinctly.

*Female*.—Primaries with distinct inner and outer lines, dark brown, the former angled subcostally, edged on one side with whitish; discal dot brown, faint. Secondaries paler red than the male, the bands diffused and moved nearer the outer margin. Abdomen ochraceous brown with black segmental bands and long white hairs.

*Expanse*.—Male, 90 mm.; female, 115 mm.

*Habitat*.—

*Type*.—Cat. No. 9466, U.S.N.M.

The specimens were received from Staudinger as "*Dirphia calchas* Stoll."

## Genus COPAXA Walker.

## COPAXA RUFINANS, new species.

Head brown. Collar gray; thorax reddish. Abdomen light brown. Primaries costa gray for over one-half from base; from base to beyond cell the wing is reddish, darkest in cell and above it; a curved black antemedial line in cell, and an oblique black line below it, angled on submedian; apical space and at inner angle dull brown; some lilacine on costa at apex; the outer line dark brown from vein 7 near margin to near middle of inner margin, preceded below vein 3 by a fine lunular dark line; outer margin broadly lilacine; a fine hyaline streak at end of cell edged with black and yellow. Secondaries dull brown; a straight black antemedial line; a spot at end of cell as on fore wings; a broad postmedial reddish shade followed by dentate black line, and then by a narrow reddish shade; the outer margin shaded with reddish.

*Expanse*.—108 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9467, U.S.N.M.

## COPAXA MARONA, new species.

Head dark brown. Collar gray; thorax and abdomen dark fawn. Wings grayish fawn. Primaries: costa gray to beyond middle; cell light reddish brown crossed by a black line; an antemedial black line

below cell; base of median vein black; a black line from costa to cell spot, which is large, hyaline, edged by a geminate black line; a black line from vein 7 at outer margin to beyond middle of inner margin, preceded below vein 6 by a lunular black line; outer margin tinged with gray. Secondaries: a black antemedial line; cell spot as on primaries followed by a narrow reddish brown shade, and then by black streaks on the veins connected by a fine, black, irregular line; a submarginal black line.

*Expanse*.—97 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9468, U.S.N.M.

**COPAXA LINEATA**, new species.

Body pinkish fawn color. Wings roseate brown, irrorated with blackish striæ; discocellular, veins from cell and submedian dark brown; a straight postmedial brown line; a subterminal fine brown line; an oblique brown line from costa near base to middle of inner margin; a whitish shade at apex. Secondaries similarly marked, the veins, a straight mesial line and a curved submarginal line dark brown.

*Expanse*.—107 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9469, U.S.N.M.

Genus **HYLESIA** Hübner.

**HYLESIA TERRANEA**, new species.

*Female*.—Uniformly dark brown, unmarked; wings slightly translucent; faint traces of a darker discal mark; abdomen with dark yellow tuftings at the sides.

*Expanse*.—53 mm.

*Habitat*.—Petropolis, Brazil.

*Type*.—Cat. No. 9470, U.S.N.M.

Family **LYMANTRIIDÆ**.

Genus **CAVIRIA** Walker.

**CAVIRIA VESTALIS**, new species.

Body white; palpi laterally streaked with black. Primaries white, silvery, but not so brilliant as in *C. regina* Cramer, with three duller white shades inwardly oblique from costa. Secondaries white. Antennæ pale straw color.

*Expanse*.—30 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9471, U.S.N.M.

Allied to *C. substrigosa* Walker.

Genus *ELORIA* Walker.*ELORIA CUBANA*, new species.

Antennæ brownish yellow; body and wings white, thinly scaled.

*Expanse*.—35 mm.

*Habitat*.—Baracoa, Cuba.

*Type*.—Cat. No. 9472, U.S.N.M.

*ELORIA AROENSIS*, new species.

Antennæ dark gray. Body and wings white. Primaries: the costa very finely dark gray; the apical area smoky gray. Underneath the apex broadly light brown.

*Expanse*.—37 mm.

*Habitat*.—Aroa, Venezuela.

*Type*.—Cat. No. 9473, U.S.N.M.

*ELORIA SERENA*, new species.

Head and collar pale yellow. Antennæ dark grey; thorax and abdomen white. Legs streaked with black and grey; wings white. Primaries: the costa black; the fringe above vein 4 greyish; the apex slightly greyish. Underneath the apex is blackish grey, the veins darker.

*Expanse*.—37 mm.

*Habitat*.—Rockstone, British Guiana.

*Type*.—Cat. No. 9474, U.S.N.M.

Allied to *E. grandis* Druce.

Genus *DOA* Neumoegen and Dyar.*DOA ? CUBANA*, new species.

Body pale grey; antennæ and legs darker grey. Primaries whitish, thinly scaled; a broad median pale grey shade; the outer margin grey; a pale grey postmedial shade from vein 5 to inner margin; two black points at end of cell followed from there to costa by a dark grey shade, widest on costa. Secondaries pale smoky grey.

*Expanse*.—35 mm.

*Habitat*.—Matanzas, Cuba.

*Type*.—Cat. No. 9475, U.S.N.M.

Genus *MANTRUDA*, new genus.

Antennæ pectinated on basal half, tip serrate; palpi upturned to middle of front; legs densely hairy. Primaries rather squarely triangular; vein 5 arising near 4, 6, and 7 stalked, 8 absent, 9, 10, 11 from cell. Hind wings with the costa with an irregular lobe outwardly; vein 5 near the lower angle of cell, 6 and 7 from a point, 8 anastomosing at base, bent out into the costal lobe.

**MANTRUDA ERRATICA**, new species.

Thorax dark brown; antennæ strongly bipectinate, the tips serrate. Primaries dark brown, sericeous, with faint traces of darker lines. Secondaries with the costal margin expanded in two lobes, the outer one larger; a small projection between veins 6 and 7; costa dark brown; disk white; inner and outer margins pale brown. Legs brown, the middle tibiæ especially dark. Abdomen pale brown.

*Expanse*.—28 mm.

*Habitat*.—Aroa, Venezuela.

*Type*.—Cat. No. 8283, U.S.N.M.

Genus **PHECADA** Walker.

**PHECADA JOANNA**, new species.

Antennæ bipectinate to the tips, the shaft white, pectinations pale testaceous. Primaries sericeous sordid grey; medial space all over-spread with violaceous brown between the arcuate inner and crenulate outer lines, except about end of cell and in center of space below and above vein 1; a faint dark shade along margin above, terminating obliquely to apex. Hind wing similar, the median dark band narrow and less distinct. Below two common dark crenulate approximate lines and faint discal dots.

*Expanse*.—50 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 8284, U.S.N.M.

Family **EUPTEROTIDÆ**.

Genus **CARTHARA** Walker.

**CARTHARA ROSEILINEA**, new species.

Primaries dark olive brown, the costa pale carneous shaded, especially subapically; a violaceous ray along median vein, furcate on veins 3 and 4 to margin, inclosing a pale space; inner line pale, faint; outer line near the margin, excurved parallel to the bent margin, distinct, whitish, narrow above, obscure below; a minute black discal dot; a marginal violaceous shade, obsolete below. Secondaries violaceous brown, paler on costa edge; outer line pale, dark within, bent in the middle; blackish superposed bars on inner margin. Collar dark brown; body violaceous shaded. Below, costa and inner margin broadly yellowish carneous; secondaries dark brown; a white discal dot; outer line more distinct than above, white near angle, cutting a black patch, which is the continuation of a faint narrow black inner mesial line.

*Expanse*.—32 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 8285, U.S.N.M.

**CARTHARA UMBRATA**, new species.

*Male*.—Primaries sordid ochereous in ground but overlaid with red-brown and olivaceous. Base washed with red-brown; inner line whitish, lilaceous shaded, dentate on median vein, followed by a broad dark-brown olivaceous shaded band; median space of the pale ground color, washed with lilaceous centrally; outer line fine, pale, waved in arcs between the veins, preceded by a broad dark band like the inner one, followed above vein 4 by an olivaceous brown band, incised on its outer edge above vein 4, squarely terminated; veins 3 to 6 narrowly light yellow; two small superposed dark discal dots; fringe dark red in the subapical excavation. Secondaries ochereous, washed with dark red in patches; mesial lines two, approximate, parallel, slightly flexuous; fringe dark red; inner margin dark red with brown and whitish bars, not strongly relieved. Below dark red-brown; outer margin of primaries violaceous, inner broadly pale yellow; two dark wavy mesial lines on both wings; a discal bar on secondaries, the anal angle broadly dark shaded, the shade cut in two pale arcs by the outer line.

*Female*.—Larger, less brightly colored; the outer of the dark bands of primaries is obsolete below vein 4, but its edges persist as waved dark lines. Secondaries overspread with brown.

*Expanse*.—Male, 35 mm., female, 48 mm.

*Habitat*.—Chiriqui, Panama.

*Type*.—Cat. No. 8286, U.S.N.M.

## Family DIOPTIDÆ.

## Genus LAURON Walker.

**LAURON ALBIPLAGA**, new species.

Black, with a blue reflection; patagia orange red; a large rounded white subapical spot on primaries, not attaining costa or margin. A broad subventral white band on abdomen.

*Expanse*.—36 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 8287, U.S.N.M.

## Family NOCTUIDÆ.

## Genus ERIOPYGA Guenée.

**ERIOPYGA GRISEIRENA**, new species.

Antennæ serrate and fasciculate. Primaries red-brown, vinous shaded, lighter in basal and outer median spaces; lines clouded, obscure, the subterminal the most distinct, twice arcuate, limiting the distinctly darker terminal space; reniform large, powdery whitish gray filled, dark below, obscurely limited; other spots obsolete. Hind

wings subpellucid, veins dark, costa, median interspaces and fringe vinous tinted. Below vinous tinted outwardly; an outer dark band on primaries and costal half of secondaries.

*Expanse*.—41 mm.

*Habitat*.—

*Type*.—Cat. No. 9516, U.S.N.M.

Genus XYLINISSA Hampson.

XYLINISSA LIGNITIS, new species.

Antennæ moderately pectinated on basal half, the tips simple. Primaries dark ashen, the median space below stigmata darkened. Orbicular large, oblong, as large as the reniform, both of the ground color, indistinctly outlined in black; lines obsolete; a subterminal row of short black venular dashes; terminal space narrowly dark, limited by a faint pale line within, roundedly incised at vein 3; a black spot in submedian interspace edging an intensification of the subterminal line. Secondaries white, subpellucid, the veins black lined; fringe white.

*Expanse*.—32 mm.

*Habitat*.—Bogota, Colombia.

*Type*.—Cat. No. 9517, U.S.N.M.

Genus EUDIPNA Walker.

EUDIPNA TEMPLADA, new species.

Antennæ serrate and ciliate. Primaries brown-grey, finely irrorated over a lighter ground, which appears irregularly. Lines single, finely waved, black, pale edged without, the black part obsolete below submedian vein; claviform orbicular and reniform concolorous, narrowly dark outlined, the reniform with small white specks without; subterminal line irregular, wavy, broken, narrowly pale, inclining to be divided into spots; a diffuse white subapical shade; a black patch below it between veins 4 and 5; a terminal black line and venular white points. Secondaries blackish brown with white specks before the margin mesially; fringe apically pale, spotted with brown mesially; a terminal broken black line. Below light brownish, brown irrorate; two common dark brown mesial lines inclosing the discal dots, those of fore wings marked with black on costa and with four costo-apical white dots, of hind wing, widely excurved mesially, the outer produced crenulate between the veins.

*Expanse*.—40 mm.

*Habitat*.—Oaxaca, Mexico.

*Type*.—Cat. No. 9518, U.S.N.M.

Genus *NÆNIA* Stephens.*NÆNIA RANDA*, new species.

Grey-brown; primaries mottled and specked in pale ochereous; lines obsolete, dotted, lost in the general uneven surface; orbicular and reniform traceable, large, the reniform with more conspicuous pale included dot; transverse posterior line punctiform, subterminal of larger pale cusps; a large deep black irregularly quadrangular blotch in median space between vein 1 and median and between transverse anterior and posterior lines. Secondaries whitish at base, outer two-fifths dark gray brown, preceded by a dark outer mesial line; some black and white specks on fold at vein 2; fringe pale above, black lined near angle. Below pale, primaries largely dark powdered; two wavy outer lines and discal spots brown-gray, the submarginal line broad.

*Expanse*.—30 mm.

*Habitat*.—Trinidad, British West Indies.

*Type*.—No. 9519, U.S.N.M.

A female from St. Jean, French Guiana, has the secondaries all dark and a blue patch on inner margin near base.

*NÆNIA SABRELLA*, new species.

Warm, pinkish brown; basal line geminate, black, crenulate, filled by the warm ground color; transverse anterior and posterior lines similar, tending to be broken into lunules, the black edge next median space heavier in both; median space above vein 1 filled in with smoky brown, relieving the large orbicular and reniform, which are of the ground color, obscurely paler ringed; a wavy black mesial line from the reniform downward; a small spot below orbicular; terminal and subterminal spaces checkered, the subterminal line irregular wavy, of the ground color; a row of terminal black points preceded by little pale specks. Hind wing blackish brown; a faint narrow outer pale line with black speck above anal angle; fringe pale ochereous pinkish. Below primaries blackish except the pale discal mark and two bands near the margin. Secondaries powdered black; inner line, discal dot, outer crenulate line and submarginal band, all black.

*Expanse*.—36 mm.

*Habitat*.—Petropolis, Brazil.

*Type*.—Cat. No. 9520, U.S.N.M.

Genus *INGURA* Guenée.*INGURA SABULOSA*, new species.

Dark gray-brown, variegated with white; a round luteous spot near base, preceded by white specks; ordinary lines black, fine, obscured in the dark ground; orbicular round, white; reniform a broad white ring with black center; a row of costal white specks before apex; area

of transverse posterior line black shaded; apex to middle of outer margin white washed, the fringe black spotted. Secondaries whitish brown at base, veins and outer half blackish brown, a small white area at anal angle; fringe black and white. Below the costal white spots are repeated, enlarged, and there is white at apex; secondaries with mesial, outer and submarginal lines, the margin dark grey, the white at anal angle repeated.

*Expanse*.—28 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9521, U.S.N.M.

Genus MAKAPTA, new genus.

Palpi upturned, reaching above vertex, third joint three times as long as wide. Hind wings with vein 5 from near the middle of cell, weak; fore wings with the apex square, acute. Front smooth, rounded; tibiæ smooth; eyes naked; thorax with a posterior crest; vestiture hairy.

MAKAPTA CARNECENS, new species.

Primaries bronzy reddish, darker over cell and margin; a conspicuous white lunate discal mark; transverse posterior line only visible, though the surface is slightly mottled; this line is regularly curved, even, dark brown. Secondaries blackish with dull vinous fringe. Below dark, vinous tinted except the disk of fore wings, which is sericeous blackish.

*Expanse*.—30 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9522, U.S.N.M.

Genus KOHLERA, new genus.

Male antennæ ciliate; palpi upturned to middle of front, third joint minute; proboscis present; eyes naked; tibiæ without spines. Hind wings with vein 5 weak, from below the angle of discocellulars.

KOHLERA NEBULA, new species.

Bronzy reddish shining, lines in dark brown; transverse anterior and posterior lines even, geminate, the anterior scarcely curved, the posterior slightly excurved over cell, moderately oblique; orbicular and reniform outlined in brown rings; subterminal line of brown spots; margin and fringe dark. Secondaries clear shining white, contrasting. Below primaries and costal edge of secondaries powdered with red-brown, inner two-thirds of secondaries white; a common outer line in the powdered part.

*Expanse*.—32 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9523, U.S.N.M.

**KOHLERIA BRUMA, new species.**

Slender; shining violaceous brown; orbicular and reniform neatly relieved, paler, faintly dark outlined; lines fine, geminate, brown, narrow, not contrasted, appearing as part of a checkering of the surface; subterminal line shaded brown, distinct, the ground color darkened at margin. Secondaries brown-gray, shining, pale over disk. Below powdered in dark, without lines.

*Expanse*.—28 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9524, U.S.N.M.

**Genus PERIGEA Guenée.****PERIGEA CHARADA, new species.**

Lustrous purplish brown, powdery; lines obscure, dark, geminate, paler filled; orbicular and reniform paler, scarcely outlined, separated by a darkening of the ground color; subterminal line dark within, pale without, dislocated subcostally, else nearly straight; fringe interlined with dark. Secondaries smoky brown, pale at base, fringe purplish with a dark line. Below primaries and costal half of secondaries dark powdered; a common dark outer line and fainter submarginal one.

*Expanse*.—30 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9525, U.S.N.M.

**PERIGEA CENOLA, new species.**

Darkly blackish, shining; costa of a lighter yellowish shade broadly from base to beyond transverse posterior line, where a reddish color obtains to margin, the terminal space again blackish. Lines obscure, punctate on the veins, the transverse posterior showing in the red shade as three rows of black dots; spots indicated by narrow black lines with a little paler filling, but scarcely relieved; subterminal line reddish, wavy, diffused. Hind wing whitish, smoky along the margin; a black line at base of fringe. Thorax blackish, abdomen pale.

*Expanse*.—30 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9526, U.S.N.M.

**PERIGEA SECORVA, new species.**

Thorax dark brown, its tufts lighter, orbits and base of patagia pale. Abdomen pale gray with dorsal blackish spots. Primaries pale gray, shaded with dark red-brown in median space below the stigmata and in marginal space below the apical dash; costa light gray, faintly greenish tinted, with many black spots along the edge; lines obsolete,

transverse anterior visible below, waved; transverse posterior very slight. Reniform and orbicular large, pale filled, each with an imperfect black line within the edge; ground color ochereous tinted below the costa; subterminal line slender, black, from end of a heavy black subapical dash straight to inner margin, followed by a row of black points, which crosses the dash to costa; a row of small terminal black points. Hind wings white; an outer smoky border and small points on veins beyond middle; fringe white.

*Expanse*.—35 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9527, U.S.N.M.

Genus NONAGRIA Hübner.

NONAGRIA INFERNA, new species.

Purplish black; primaries powdered with violaceous below cell; ordinary spots black, punctiform, the orbicular a short dash surrounded by violaceous scales, the reniform a round dot; a black dash between them and a small one following the reniform; lines lost, except the subterminal, which is black, a little irregular, powdery, maculate; a row of terminal black dashes. Hind wing creamy white, strongly contrasted, gray powdered a little at apex. Abdomen dark brown. Below primaries and one-third of secondaries smoky brown, the rest of secondaries creamy white.

*Expanse*.—28 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9528, U.S.N.M.

Genus HADENA Schrank.

HADENA JONEA, new species.

Pale gray, whitish, overlaid with dark gray shades. Thorax whitish, black speckled, collar rufous. Ordinary spots large, round, white, broadly olivaceous filled and narrowly black outlined; a dark linear shade from costa between them; a number of dark costal dashes; lines obsolete, the transverse posterior very far out, linear, black, dentate, the dentations pale filled without; a black dash for claviform, forming a bar to median shade, succeeded by a bar touching transverse posterior line; subterminal line close to the transverse posterior, pale, faint, waved, enclosing a black shade at costa. Hind wing white, shining, a blackish shade at apex and diminishingly along margin.

*Expanse*.—30 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9529, U.S.N.M.

## Genus CARBONA, new genus.

Palpi smoothly scaled, upturned, third joint small; eyes naked; tibiae nonspinose; antennae simple; vestiture scale-tipped hair, some metallic scales at back of thorax. Hind wings with vein 5 weak, from below the middle of discocellulars.

## CARBONA OBSCURA, new species.

Brown-black, inner area of primaries uniformly obscured; filling of basal, transverse anterior and posterior lines shows on costal half as yellowish lunules, supplemented by yellowish costal bars toward apex; ordinary spots tinged in burnt brown, dark filled, obscurely black ringed. Hind wing shining black-brown. Below as hind wing above, without marks.

*Expanse*.—30 mm.

*Habitat*.—Petropolis, Brazil.

*Type*.—Cat. No. 9530, U.S.N.M.

## Genus OLIGIA Hübner.

## OLIGIA FUSCOMA, new species.

Thorax variegated in clay color and dark brown. Primaries with the costa straight, the wing narrow; dark brown, slightly bronzy; a clay colored space at base surrounding the narrow dark subbasal line, projected on median vein; transverse anterior line of four clay colored cusps, the lower one outwardly dislocated; orbicular and reniform outlined in clay color; a broad costo-apical clay colored patch from which the transverse posterior line depends, excurved around reniform; subterminal line parallel to margin, defining the lighter terminal space. Secondaries grey-brown with large dark discal dot.

*Expanse*.—21 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9531, U.S.N.M.

## Genus SEMIOPHORA Stephens.

## SEMIOPHORA BASTULA, new species.

Bronzy brown; a round white spot in upper segment of reniform broken into three specks by dark scales; orbicular narrowly white ringed; ordinary lines very obscure, black, punctiform, geminate, the subterminal a faint wavy, pale shade. Secondaries blackish; discal

spot darker. Below dark powdered; a common dark outer line and discal spots, that of the secondaries larger.

*Expanse*.—23 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9532, U.S.N.M.

**SEMIOPHORA PUNCTULA**, new species.

As in the preceding species, but without the white spots in the reniform. This is black filled, narrowly pale ringed, the upper segment of the ring white; circle of orbicular nearly without white. The color is a little less reddish, more faded than in *S. bastula*. It is perhaps a variety thereof.

*Expanse*.—23 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9533, U.S.N.M.

**Genus EUSTROTIA** Hübner.

**EUSTROTIA GEOGA**, new species.

Dark grey; apex a little touched with white; a faint white shade over reniform; lines single, black, transverse anterior nearly straight, posterior gently excurved over cell, subterminal finely dentate, limiting a dark shade, which runs nearly to transverse posterior line; this line reddish bordered below without; claviform small, black outlined; orbicular and reniform obscurely black outlined, pale filled; traces of a median black line; a row of black terminal dashes. Hind wing pale brownish; an outer punctate dark line; outer margin and fringe lined in blackish.

*Expanse*.—21 mm.

*Habitat*.—Guadalajara, Mexico.

*Type*.—Cat. No. 9534, U.S.N.M.

**Genus ISCADIA** Walker.

**ISCADIA NIGRA**, new species.

Blackish with a slight gray overcast; transverse anterior line black, slightly oblique, nearly straight, obscurely geminate, the inner gemination brownish, the filling pale, but not contrasted; orbicular circular, pale with a brown center; reniform elliptical, broadly black ringed, concolorous filled with a comparatively small reniform black center; an ashen space on costa before it containing a small black dash; transverse posterior line from costa above reniform, rounded outward parallel to costa, then angled sharply downward, dentate on the veins to below reniform, where it is retracted inward to touch the ring of the reniform, and then runs more obscurely to margin; subterminal

line whitish, irregularly dentate. Hind wings pure translucent white; a smoky black narrow border along outer margin.

*Expanse*.—34 mm.

*Habitat*.—Tucuman, Argentine.

*Type*.—Cat. No. 9535, U.S.N.M.

**ISCADIA DUCKINFELDIA, new species.**

Light gray shaded with dark; a broad blotch on costa from transverse anterior to posterior lines of smoky brown, edged with black streaks below; lines as in *I. nigra*, rufous edged, the transverse posterior continuous with the ring of reniform, which seems a part of it, broadly encircling the reniform center; subterminal line with blackish spots within. Hind wing sordid white, with black diffused outer edge.

*Expanse*.—36 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9536, U.S.N.M.

**ISCADIA STROCA, new species.**

White with a grayish tint. Thorax stained with yellowish; collar with three black lines; patagia grayish spotted. Subbasal line dotted; transverse interior excurved in middle, slightly waved, the space between them partly washed in red-brown; black spots along costa, heavier toward apex; trace of a mesial line; a large, round, narrow ringlet for reniform; transverse posterior line slender, black, wavy to below reniform, then bent inward to nearly touch the ringlet and strongly wavy to margin; subterminal line a waved black shade, the subterminal space shaded in red-brown; a row of terminal black dots. Hind wing white.

*Expanse*.—31 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9537, U.S.N.M.

**Genus TÆNIOCAMPA Guenée.**

**TÆNIOCAMPA NAOLINA, new species.**

Bright red-brown; lower half of median space and area about transverse posterior line washed with purplish; transverse anterior line obsolete, it and the subbasal one indicated by yellowish lunules on costa; transverse posterior line slender black, deeply dentate; subterminal line light reddish, wavy, diffuse; orbicular triangularly rounded on lower inner side, bright white edged, orange filled; reniform orange, with a white dot above and below within and row of white specks without; a small white mark at end of obsolete claviform. Hind wing brownish, a large dark discal spot and faint outer line; fringe pinkish.

Below light colored; discal spots large, pale, contrasted; a dark transverse posterior line; hind wing with the discal spot and line much more distinct on the pale ground.

*Expanse*.—30 mm.

*Habitat*.—Rio Janeiro, Brazil.

*Type*.—Cat. No. 9538, U.S.N.M.

Genus *COPHANTA* Walker.

*COPHANTA CHRYSARGINEA*, new species.

Blackish brown, the fore wings with a blue metallic luster except on the space between transverse posterior line and cell; transverse anterior line narrow, yellow, forming four arcs; discal dot a dark, very faint discoloration; transverse posterior line indicated by a yellow dot on costa, arcuate, obsolete, finely geminate; three yellow dots on costa beyond; terminal space a little lighter without lines. Secondaries all dark brown-black, slightly bronzy. Below greyish black, discal dots and outer line faintly traced by following pale shades.

*Expanse*.—20 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9539, U.S.N.M.

Genus *PLUSIA* Ochsenheimer.

*PLUSIA CAUDATA*, new species.

Head and collar ochereous brown, thoracic tufts purplish black. Primaries deep purplish brown with a bronzy reflection; basal space variegated in clay color; transverse anterior line of this color, straight, produced inward on subcostal vein; sign a mark of 8, the outer segment filled with yellowish silver, the inner part broken, the two segments directed against median vein; transverse posterior line dentate, traversing a clay-colored area from costa to vein 5; terminal space variegated with clay color; fringes of this color with purplish strigæ. Hind wing dark brown, lighter in cell to base; fringe pale, interlined with brown.

*Expanse*.—36 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9540, U.S.N.M.

Genus *ACANTHODICA* Schaus.

*ACANTHODICA PAMELA*, new species.

Collar clay color with brown margin, thorax gray, abdomen yellowish. Primaries grey, inner and outer halves clay colored, mottled in grey; transverse anterior line far out, straight, broken into slightly curved dashes, preceded by a black patch above and below vein 1; orbicular and reniform round, faintly defined, grey; a large circular

spot below reniform, ochereous grey, faintly ringed, darker centered; transverse posterior line far out, slightly curved, brown black, nearly continuous, followed by a dark-grey narrow shade; an irregular mottling for subterminal line; a rounded white apical blotch. Secondaries pearly white, veins and margin narrowly blackish; fringe yellowish.

*Expanse*.—43 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9541, U.S.N.M.

Genus **TRILEUCA** Grote.

**TRILEUCA OCHRACEA**, new species.

Yellowish clay color, finely brown irrorate, shading to dark brown along outer margin; three slender brown lines, the transverse anterior far from base, straight, bent on subcostal vein; a narrow brown discal lunule; transverse posterior line produced in a sharp point on vein 6; subterminal line excurved over the point of transverse posterior line, slightly angled on the veins, else regular and even. Hind wings bright ochereous, fringe brownish. Below brown powdered, disk of fore wings bright ocher.

*Expanse*.—40 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9542, U.S.N.M.

Genus **PHIBROMIA**, new genus.

Eyes naked, large; palpi porrect, about twice as long as head, the third joint small; antennæ simple; tibiæ nonspinose. Hind wings with vein 5 distinct, curved, arising well above vein 4.

**PHIBROMIA NARECTA**, new species.

Dark ochereous, powdered with red; transverse anterior line narrow, brown, bent in an angle on submedian; orbicular round, black, white centered; reniform narrow, lunate, concolorous, relieved by dark scales, fused at both ends to the transverse posterior line, which makes a round excurve over it, is concolorous above, defined in a dark-brown shade, white and perpendicular below. Subterminal line faint, flexuous, defining the outer edge of a broad dark-brown shade band; terminal space brown powdered; a row of small dark terminal dots; fringe dark. Hind wings yellowish white; a diffused dark outer line and a half mesial line on inner margin; a terminal row of black specks; fringe brown spotted.

*Expanse*.—25 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9543, U.S.N.M.

Genus *RHAESENA* Walker.*RHAESENA JALAPENA*, new species.

Violaceous clay color, overlaid with dark brown shades; transverse anterior line bent at right angles on median, pale brown edged within; transverse posterior oblique, straight from middle of costa to outer third of inner margin, pale, edged within by a wide brown shade that diffuses nearly to transverse anterior line; reniform mark beyond this line minute, but with a curved brown line to costa (the true transverse posterior line), the curve filled in by a dark shade; terminal area brown shaded, blackish at apex; subterminal line fine, pale, obscure. Secondaries blackish. Below reddish irrorate, disk of primaries blackish, a common faint darker line.

*Expanse*.—23 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9544, U.S.N.M.

*RHAESENA NEZEILA*, new species.

Pale violaceous brownish with dark brown shades; basal half of primaries brown, shading darker before the lines, a light submetallic reflection in basal space; transverse anterior line narrow, brown, angled on median and submedian veins; transverse posterior straight across wing, limiting the dark basal area; lighter beyond, with submetallic violaceous reflection; reniform a brown speck beyond the transverse posterior line, around which the true posterior line makes a broad outcurve, slender, brown, flexuous; outer margin prominent below the middle, the upper excavation with a dark brown shade which runs obliquely inward; subterminal line pale, submacular, brown edged within. Hind wing blackish with an elliptical fovea in lower part of cell in the male. Below violaceous tinted, brown speckled, outer margins, especially of hind wings, red; a common mesial line, crenulate on hind wings, which have also a discal dot and a faint submarginal line.

*Expanse*.—27 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9545, U.S.N.M.

*RHAESENA RUBROMARGINATA*, new species.

Dark purplish brown; fore wings with the space to median line shaded in dark bronzy brown, the transverse anterior line relieved by a little pale shading, slender, brown, angled on submedian; orbicular large, circular, paler filled; median line narrow, male, straight across wing, limiting the dark area; reniform an obscure irregular line; transverse posterior line slender, dark, roundedly excurved over reni-

form, running very close to median line below; subterminal line rather distant from the margin, narrow, yellowish, breaking into spots on the veins below, preceded by a dark bronzy-brown patch on costa and at margin and followed by one obliquely from the costal patch to the angle of the outer margin. Secondaries blackish brown. Below blackish brown, apex of fore wings and submarginal area of hind wings irrorated with bright red, of the hind wings inclosing a diffuse dark-brown band; a faint discal spot.

*Expanse*.—27 mm.

*Habitat*.—

*Type*.—Cat. No. 9566, U.S.N.M.

Genus PHIPROSOPUS Grote.

PHIPROSOPUS HYPENOIDES, new species.

Brownish ochereous, fore wings with reddish shades over cell and submedian fold; transverse anterior line faint, blackish on lower half only; a white point for reniform, below which a narrow white line runs straight to margin, blackish edged within; subterminal line sinuate, composed of a row of black blotches. Hind wing pale ochereous, gray tinted especially at margin. Below like hind wings above, a broad blackish shade on disk of fore wings to subterminal line; a common slender extra mesial line and discal dots.

*Expanse*.—31 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9546, U.S.N.M.

Genus CASANDRIA Walker.

CASANDRIA CHIRICA, new species.

Light gray, slightly metallic shining, inner area broadly shading dark; lines narrow, black; basal line arcuate from costa to base of median vein; transverse anterior waved, transverse posterior obsolete below, the upper segment distinct, angled inward subcostally; subterminal line finely dentate, white above, dark and fainter below. Hind wing pellucid whitish, veins and margin smoky gray. Below, primaries with costa and outer margin of secondaries dark smoky, disk pellucid.

*Expanse*.—33 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9547, U.S.N.M.

Genus SCHAZAMA, new genus.

Eyes naked, lashed; palpi upturned, slight, reaching the middle of the front; antennæ appressed pectinate. Hind wings with vein 5 distinct, arising above 4, but shortly so. Abdomen with long furcate anal tuft. Female with single frenulum.

**SCHAZAMA ANGUSTIPENNIS**, new species.

Primaries long, triangular, all the area below the middle of cell smooth and whitish as if partly denuded, evidently folded in rest; costa gray with reddish irrorations; transverse anterior line black, fine on costa, a dot on median vein, a strong streak on inner margin; reniform a round black dot with a pale ring, cut in two on median fold, lower half obsolete; transverse posterior line geminate on costa, a dot on median vein and inner margin. Hind wings whitish subpellucid; a dark discal dot, marginal edge and fringe grey-black. Abdomen with a pair of long terminal tufts.

*Expanse*.—27 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9548, U.S.N.M.

**Genus CORUBIA**, new genus.

Eyes large, naked; tongue small; palpi porrect, the second joint brush-like with scales above and below, third joint slender, deflexed, not exceeding the hair of the second joint. Tibiæ smoothly scaled, nonspinose. Hind wing with vein 5 well developed, from the lower third of discocellulars.

**CORUBIA TESTACEA**, new species.

Dark orange testaceous, lines blackish; transverse anterior bent at right angles on median vein; orbicular a round dot; reniform an upright streak; transverse posterior line oblique from costa near apex to outer third of inner margin, straight; no subterminal. Hind wings ochraceous, blackish powdered all over. Below disk of fore wings blackish shaded.

*Expanse*.—22 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9549, U.S.N.M.

**Genus DORYODES** Guenée.**DORYODES ELONGATA**, new species.

Fore wing lengthily produced at apex, outer margin strongly oblique. Light pinkish, finely and densely dark irrorate; a broad pale gray band from apex over cell nearly to base; another above inner margin; a slender ray from apex toward middle of margin; center of wing slightly ochraceous. Hind wing creamy white.

*Expanse*.—36 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9550, U.S.N.M.

Genus *CAROGA*, new genus.

Eyes large, naked; palpi upturned to vertex, the third joint small, second long and pilose; legs long, hind tibiae hairy. Hind wing with vein 5 distinct, from lower fourth of the discocellulars; wings broad, ample.

*CAROGA COSTALIS*, new species.

Wings broad, smoky brown, shining, uniform; costa very broadly whitish brown from base to apex; transverse posterior line dark brown, diffuse, very faintly crossing the pale costal space; other lines lost; a dark mark at base and row of terminal spots. Hind wing unspotted. Abdomen long, dark brown. Below wings lighter, each with a rounded blackish discal spot.

*Expanse*.—37 mm.

*Habitat*.—Rio Janeiro, Brazil.

*Type*.—Cat. No. 9551, U.S.N.M.

Genus *PHÆOCHLÆNA* Hübner.*PHÆOCHLÆNA CUPREA*, new species.

Dark brown with purplish luster; transverse anterior and posterior lines fine, irregular, linearly pale with brown borders within; a round, punctiform yellowish white discal dot; subterminal line waved, fine, like the other lines; terminal space a shade paler. Hind wing dark brown. Below much lighter, especially toward base.

*Expanse*.—24 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9552, U.S.N.M.

Genus *PALINDIA* Guenée.*PALINDIA ARGENTILINEA*, new species.

Bright grass green; costa narrowly ochereous with little black streaks; transverse anterior, median and posterior lines all oblique, subparallel, rather closely placed, pale brown, pale silvery edged without; a brown patch on transverse anterior line in submedian fold; a straight terminal silver line. Hind wing whitish on costa, else green, the terminal silver line expanded at the angle in the margin before a round blackish patch with pale edge. Below silky white, green tinged, fringes black.

*Expanse*.—35 mm.

*Habitat*.—Rio Janeiro, Brazil.

*Type*.—Cat. No. 9553, U.S.N.M.

## Genus GONODONTA Hübner.

## GONODONTA MARMORATA, new species.

Body blackish brown, patagia blackish tipped, collar grey irrorate; primaries dark brown in median and submedian spaces, pale clay color terminally; basal space confused with brown, purplish and clay color shades, the line lost; transverse anterior and posterior lines limit the dark median space, but are themselves indistinct, though traceable, black, strongly wavy; reniform paler than the ground, constricted, narrowly dark centered; a slender black line before the subterminal, wavy, preceded by a small white space on costa and joined to the dark median space centrally by bluish black; terminal space mottled in brown and purplish on a pale ground, the subterminal line wavy, dark, linear; termen and fringe dark. Secondaries brown-black, disk broadly orange yellow from costa over median nervules. Below blackish brown, primaries with a spot at base and termen lighter, secondaries with the yellow mark enlarged over costa to base.

*Expanse*.—43 mm.

*Habitat*.—Coatepec, Mexico.

*Type*.—Cat. No. 9554, U.S.N.M.

## Genus HOMOPYRALIS Grote.

## HOMOPYRALIS PICTA, new species.

Head, thorax, and bases of both wings light cream colored, the outer parts of wings densely shaded in with dark brown and purplish; reniform, a dark bar in a small light space; transverse, anterior, and posterior lines obscure in the dark area, narrow, blackish, wavy; subterminal similar, but more decidedly wavy, and followed by a small light space; a round dark blotch on middle of outer margin; fringe spotted. Secondaries with two median dark lines, the outer twice strongly dentate, the area between powdery brown; discal dot rounded, black; submarginal line faint, wavy, preceded by brown blotches; a crenulate line at base of fringe, which is spotted. Below pale, shaded and peppered with brown, without any contrasting pale basal space; a common outer and inner wavy lines and discal spots, the lines indistinctly doubled.

*Expanse*.—22 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9555, U.S.N.M.

## HOMOPYRALIS PANDAMA, new species.

Pale ochreous, dark olivaceous, tinged and with patches of slightly bronzy reddish on disks and submedian fold of both wings; primaries with a broad brown-black subbasal band; orbicular a round dot; two

median lines, wavy, the outer somewhat broken and absorbing the small reniform dot; transverse posterior line wavy, broken; subterminal near the margin, waved, broken below, broad, touching at middle of margin a large dark spot in the fringe; a row of terminal black spots. Secondaries with two mesial lines, coarsely waved, inclosing the small discal dot, from which a faint shade runs to the inner margin; terminal space distinctly olivaceous, with a broken blotchy submarginal line; a crenulate terminal line; a dark spot in fringe in center of margin. Below two common lines and discal dots, the margins broadly blotched in blackish brown.

*Expanse*.—25 mm.

*Habitat*.—Aroa, Venezuela.

*Type*.—Cat. No. 9556, U.S.N.M.

Genus MATIGRAMMA Grote.

MATIGRAMMA PAMELA, new species.

Pale, testaceous, the wings shaded with red-brown outwardly; primaries with a very broad blackish shaded subbasal band, which is constricted into three segments, the central one gray with a black central dash, the lower one pale; a minute punctiform orbicular; an oblique black dash on costa, succeeded below median vein by a brown line, angled on submedian; reniform a linear brown curved mark, with a faint brown line below it; transverse posterior line wavy, brown, followed on costa by a large oblique black bar; subterminal line limiting the dark-brown marginal space, produced inward opposite cell; a darker brown shade at middle of margin. Secondaries with inner line faint; discal dot a longitudinal dash, furcate toward base of wing; outer line irregular, excurved over discal dash, slender, brown; terminal space more strongly shaded in red-brown, cut by a diffused pale line; a crenulate terminal brown line. Below with common outer and inner lines and discal spots, the lines on primaries obscured by brown powderings and with three black costal bars; on secondaries the outer line crenulate and excurved over discal dot, which is elongate, but not so sharply as above.

*Expanse*.—34 mm.

*Habitat*.—

*Type*.—Cat. No. 9557, U.S.N.M.

Genus AMPHIGONIA Guenée.

AMPHIGONIA BRUNNEA, new species.

Brown; basal space of primaries dark chocolate brown, with irregular lighter markings; lines and spots obsolete, the orbicular traceable close to base as a blackish ring; color shades darker outwardly, the submarginal line faint, yellowish, bent at an angle opposite the projection of

outer margin; a row of small yellow cusps before margin. Secondaries with the subterminal area strongly empurpled, limited within by a straight lilaceous geminate line, which is produced inward in little rays on the veins; a bronzy blotch in the purple area near middle; a subterminal row of yellow cusps as on primaries; the margin crenulate and produced in the middle. Below brown, a common mesial dark line and outer waved crenulate yellowish one on fore wings excurved over cell; margins irregularly washed in whitish, the subterminal cusps repeated, but less definitely; on primaries orbicular whitish, reniform, of four dark dots and a pale one in a bluish area; on secondaries discal dot dark. Hind legs with the tibiae very broadly haired, a white spot at the knees.

*Expanse.*—42 mm.

*Habitat.*—Aroa, Venezuela.

*Type.*—Cat. No. 9558, U.S.N.M.

Genus *PETEROMA*, new genus.

Eyes large, naked; palpi upturned to vertex, third joint small; tibiae enlarged, the spurs normal. Wings broad and similarly colored as in *Homoptera*; hind wing with vein 5 distinct, from near lower angle of cell.

*PETEROMA LIGNEA*, new species.

Pale pinkish gray, a transverse black line on edge of collar and faint one in middle of thorax; abdomen with a white band at extreme base, first segment dark brown, second with a black posterior band, the others faintly banded. Primaries with outer half dark brown; a small black bar at base; transverse anterior line slender, angled on costa and median, followed by a heavy oblique black band from median to inner margin near base; orbicular a round dot; the pale basal space runs costally nearly to apex, but the rest of the wing is dark, containing geminate median and transverse posterior lines, close together, wavy, becoming very faint where they cross the pale costal space; submarginal line wavy, pale, dark edged within; a crenulate black marginal line; fringe pale at base, brown outwardly. Secondaries lightly shaded with brown, median band double, straight, broad, followed by a fainter, more wavy band; outer band triplicate, two narrow crenulate lines and a broad dark brown one; a submarginal shaded band: termen and fringe as on fore wings. Below the wings are pale, brown peppered; a dark submarginal shade on both; discal dots and common inner, median, and outer lines, narrow, crenulate, broken.

*Expanse.*—42 mm.

*Habitat.*—Aroa, Venezuela.

*Type.*—Cat. No. 9559, U.S.N.M.

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## Genus CAPNODES Guenée.

## CAPNODES VIRGINIA, new species.

Pallid testaceous, minutely brown speckled; transverse anterior line slender, brown, coarsely wavy, with a brown blotch on costa; orbicular a dot; reniform a broken dot, broadly ringed in powdery brown, the space partly filled in rusty brown; transverse posterior line excurved over reniform, dotted, not waved; subterminal crenulate, geminate, paler filled; a terminal row of brown dots. Secondaries with a faint pale space for discal dot; mesial line dotted; submarginal line and termen as on fore wings. Below with dotted mesial and submarginal lines and slight discal dots.

*Expanse*.—27 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9560, U.S.N.M.

## Genus TRIOMMATODES Warren.

## TRIOMMATODES ANGULATA, new species.

Antennæ rather lengthily pectinate; fore wings with the outer margin angled. Dark purplish brown, largely lilaceous shaded, especially over disk to inner margin and along outer margin below apex; base and costa dark; lines dark, wavy, slender, obscure; a lilaceous line cuts the dark basal color, the stigmata are very faintly outlined by the pale shading, and the transverse posterior is followed by lilaceous points; a subterminal row of lilaceous cusps and two rows of alternating terminal dots; hind wings dark with only discal dot, median row of points and crenulate marginal line lilaceous. Below the body and abdomen are pale whitish, the color spreading over base of secondaries; wings else bluish grey, the primaries with very faint lines, the secondaries with two dark wavy mesial lines, relieved on the whitish ground.

*Expanse*.—35 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9561, U.S.N.M.

## Genus BENDIS Hübner.

## BENDIS MASCARA, new species.

Brown, terminal spaces of both wings lighter; a black-brown band at base of abdomen; transverse anterior line black-brown, broad, bent at right angles on median, broken in cell, reaching inner margin near base; transverse posterior visible on costa and for a little way, narrow, faint, brown, edged with pale; four pale costal dashes beyond; subterminal line strongly excurved at middle of margin, almost touching the marginal angle; a broad brown-black shade diffusing within; a white discal point. Hind wings with a similar submedian band, diffusing to

center of wing, cut by a geminate pale lilaceous shade line which, near middle of wing, comes to limit the dark shade outwardly to anal angle; a white discal speck. Below grey-brown, margin with pale testaceous patches above angle and at tornus of fore wing, at apex of hind wing; faint crenulated dark outer line, edged narrowly with testaceous white discal dots as above.

*Expanse*.—33 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9562, U.S.N.M.

#### BENDIS THARA, new species.

Dark brown; base of fore wings darkly blackish, sharply limited; a slender pale, wavy, mesial line; transverse posterior roundedly ex-curved, parallel to margin, pale, edged within by a dark brown shade; subterminal space darkly blackish brown, bluish shaded on costa; terminal space of brown color; terminal dots faint. Hind wing with the subterminal dark shade very faintly repeated, its inner line punctiform, brown; subterminal line crenulate, obscure, a pale mesial line, dark edged basally. Below fore wings with whitish discal dot and macular outer line, terminal space lighter; hind wings similar, a submacular pale mesial line added.

*Expanse*.—32 mm.

*Habitat*.—Petropolis, Brazil.

*Type*.—Cat. No. 9563, U.S.N.M.

#### Genus CHAMINA Hübner.

#### CHAMINA CHORIA, new species.

Light brown, darker along costa, powdered with lilaceous in basal and median spaces; transverse line, median shade and posterior line darker, obscure diffused; orbicular a small dark dot; reniform narrow, constricted, a dark ring filled and surrounded by lilaceous powdering which also follows the transverse posterior line narrowly; next a dark shade, then a pale space; subterminal line near margin, obsolete, represented by scattered dark points on the veins. Hind wing with mesial punctiform dark line edged by lilaceous; an outer row of black points.

*Expanse*.—37 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9564, U.S.N.M.

#### Genus ORTHOGRAMMA Guenée.

#### ORTHOGRAMMA FEROGIA, new species.

Testaceous brown, terminal area darker as also head and thorax; transverse anterior lines slightly arcuate, geminate, light red tipped; orbicular and reniform large, brown filled, brokenly dark brown

ringed; transverse posterior line with a faint pale branch from costa, touching a blackish apical shade dash, forming a straight, geminate, light-red-filled band from apex across both wings to above anal angle of secondaries; space beyond darker brown, faintly cloudy irrorated; a submarginal row of points on both wings, white, black within; a blackish discal dot on hind wings. Below testaceous, blackish irrorate; orbicular punctiform, reniform lunate, dusky; transverse posterior line normally shaped; outer dots as above. Hind wing with double discal dot, outer line and outer dots.

*Expanse*.—42 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9565, U.S.N.M.

**ORTHOGRAMMA HERMESIA, new species.**

Red brown, antennal serrations, a line between antennæ and extreme tips of palpi white. Primaries with a narrow straight brown outer line from apex to middle of inner margin follow by minute yellowish specks on the veins; transverse anterior line obscure, of two large arcs; reniform and orbicular large, of the ground color, faintly defined by a darkening of the shade along costa; submarginal line blackish, twice broadly waved, narrow, diffused, broken into spots. Secondaries with a straight mesial line continuing the one on fore wings; a row of nearly obsolete black dots submarginally. Below lighter over base and disk of secondaries; a common mesial brown line and discal dots.

*Expanse*.—42 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9576, U.S.N.M.

**Genus COENIPETA Hübner.**

**COENIPETA GLAUROIDES, new species.**

Fore wings very dark purplish brown, mottled all over with little patches of submetallic greenish blue scales, strongest in a powdering about the obsolete reniform mark; lines pale, not well indicated, confused by the patches; anterior wavy, nearly straight; median similar, faint centrally; posterior slender, zigzag wavy, retreating below cell under the reniform, not excurved subterminal very faint; a row of slightly darker large blotches just before the margin. Secondaries shining bronzy dark brown, scarcely any trace of lines except just at the margin where are intravenular black spots, except at costa and anal angle, each preceded by a dull yellowish dash and very faintly encircled. Below lighter brown, nearly immaculate; the light yellowish inceptions of the transverse lines on costa are repeated, the secondaries have a darker straight median line and a light mottling on the margin.

*Expanse*.—41 mm.

*Habitat*.—Cavalle Cocho, Amazonas, Peru, May, July, 1884 (M. de Mathan).

*Type*.—Cat. No. 9567, U.S.N.M.

**COENIPETA LAURENA, new species.**

Fore wings very dark purplish brown, irrorate with lilaceous scales, which form a more distinct tract along median vein and vein 2 to margin, at inception of transverse posterior line on costa and in the terminal space apically; lines pale, not well indicated, confused by the powdering; a row of yellowish bars along the costa; transverse anterior line oblique, wavy, double, the outer gemination marked by a blue bar in submedian interspace; median line dark below its inception on costa, indicated by the absence of the light powdering, coarsely waved; transverse posterior dark with light edges, doubled without by a more diffuse light lilaceous line which is lost below in the general light powdering, waved, arcuate to reniform, thence coarsely waved to inner margin; reniform large, oblique, an oblique yellowish dash ringed by a pale line that becomes white on the outer segment; subterminal line finely wavy, starting near the costa but becoming remote from the margin below, pale above with dark edging but below appearing as a dark zigzag lined by the lilaceous scales and somewhat cupreous tint of the ground color; a row of dark lunules near the margin. Secondaries shining bronzy dark brown, two mesial and a submarginal lighter wavy lines most distinct centrally; a row of dark lunules close to margin preceded and followed by reddish ochreous, cut by little blue dashes at veins 2, 5, and 6; fringe dark with a yellowish patch at the marginal incision between veins 5 and 6. Below lighter brown, inner area of fore wings pale ochereous shaded; primaries with light spottings on costa, a light bar for reniform, a crenulate outer line and very light ochereous marginal patches except between veins 3 and 4, traversed by brown lunules near the margin; secondaries with three crenulate mesial lines, discal dot a dark ringlet; a white pupil followed by a black spot at margin between veins 6 and 7 and a very light ochereous marginal line near anal angle and between veins 4 and 6.

*Expanse*.—44 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9568, U.S.N.M.

**COENIPETA MEDALBA, new species.**

Primaries more pointed trigonate than in the two preceding. Dark purplish brown, all the base of wing to transverse posterior line overwashed with white; subbasal, geminate transverse anterior and geminate median lines show dark on the white ground, coarsely wavy; a

black shade obtains along inner margin near base; transverse posterior line with a large white dash on costa, below darker than the dark ground of outer space, broad, nearly straight, space from it over reniform area only a little washed in white, the reniform showing an oblique dark line without traceable ringlet; a faint crenulate dark shade paralleling the posterior line; subterminal light without, dark within, dentate-crenulate, subparallel to margin; fringe dark, irregularly marked in whitish. Secondaries blackish, shining, a diffused subcrenulate outer line centrally, approaching anal angle at inner termination; fringe white, blackish at anal angle and between veins 3 and 4 with three little marginal pale lunules centrally. Below blackish, bases of wings shaded with pale ocherous scales, on the hind wings covering all but a broad marginal band; a median and an outer dark line on fore wings, the latter broadly white edged on costal half; secondaries with two mesial dark lines and a faint discal spot; fringes as above.

*Expanse*.—39 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9569, U.S.N.M.

**COENIPETA UMBRATA, new species.**

Primaries slightly more pointed than in *C. medalba*. Basal half similarly washed with white, but more lilaceous and less solid; transverse anterior line blackish, distinct, zig zag, the others obscured; a rounded discal lunule, joining a broad outer deep brown-black shade in the transverse posterior position which diffuses to the subterminal line; this is very near the margin, dentate, pale; marginal space with cloudy blotches; fringe spotted in pale and cloudy. Secondaries brown-black, lighter brownish basally, an outer median curved dull yellow band centrally, broken on submedian fold, repeated in anal angle; anal angle lobed with an excavation above; fringe ocher, irregularly black checkered; a marginal ocher spot above the excavation, preceded by a fine line, the excavation similarly edged. Below primaries grey, shading light at base, contrasting pale ocher below vein 1; black marks on costa, from one of which a shade runs to the pale linear reniform; outer line dark, excurved, pale edged near costa; secondaries pale ocherous except a large black blotch on middle of margin; two black geminate mesial lines and black-edged discal dot; a brighter ocher shade about submedian fold; a light patch at apex.

*Expanse*.—41 mm.

*Habitat*.—Cayenne, French Guiana.

*Type*.—Cat. No. 9625, U.S.N.M.

**COENIPETA MUSA, new species.**

Primaries purplish brown, a little lighter centrally; transverse anterior and posterior lines broad, black, slightly crenulate, the anterior geminate; reniform of two broad lines, narrowly continued to

costa; subterminal line near the margin, pale, faint, dentate, inclosed in a darker shade; a small whitish patch at inception of posterior line on costa. Secondaries with a large incision above anal angle, brown-black, lighter at base, outer curved central line dull ochereous, diffused, curved toward incision; light superposed bars on inner margin; a double marginal light shade; fringe light, faintly darker shaded. Below light grayish; a dark median line on fore wing crossing the reniform bars; dark posterior line, with a white outer edge at costa; secondaries with a dark marginal shade, two crenulate mesial lines and discal dot; a marginal light shade, becoming white at apex.

*Expanse*.—30 mm.

*Habitat*.—St. Jean, French Guiana.

*Type*.—Cat. No. 9570, U.S.N.M.

**COENIPETA SUBOCELLATA, new species.**

Fore wings dark purplish brown, the lines dark, nearly obscured, the subterminal relieved by an outward paler shading, excurved subapically and mesially; a round black patch at apex, with a small white pupil inwardly. Hind wings blackish brown, two mesial darker lines and a submarginal shade followed by a dilution of the color; a row of marginal white specks centrally; a narrow yellowish line at base of fringe. Below more grayish, costal marks and lines of more wings lightened in ochereous shades, the apical ocellus repeated, more distinct, preceded by a yellowish arc; secondaries washed in pale at base, relieving a discal mark of two arcs, a geminate mesial and single outer line; a submarginal light shade, inclosing a black ocellus at apex, which has a white pupil and is cut by two yellowish dashes; a narrow yellow line at base of fringes of both wings.

*Expanse*.—41 mm.

*Habitat*.—Rockstone, British Guiana.

*Type*.—Cat. No. 9571, U.S.N.M.

**COENIPETA SUBVARIA, new species.**

Primaries dark red-brown and blackish purple; the purple color fills the anal space, lower half of median space, area from reniform to subterminal and over this line centrally to margin; lines wavy, black, obscured in the dark color, the reniform a narrow black constricted ring in a creamy ground that obtains to costa and in irregular patches about submedian fold outwardly; a row of black dashes near margin, the apical one largest. Secondaries blackish, mesial and outer lines faint, dark, wavy, narrowly lighter edged without; a row of round black marginal spots in a slightly bronzy reddish field, faintly encircled with pale. Below strongly diversified with pale and white patches; primaries powdered with whitish lilaceous subcostally and patched with white at apex; yellowish spots along costa; discal dot of three white

lines; outer line roundedly crenulate, whitish, single; a submarginal faint pale line; secondaries a little light powdered; discal dot with a white line within and a large round white patch without; outer line crenulate, pale; a submarginal paler line above a series of white cusps near margin, the one nearest apex large, obsolete toward anal angle; fringe with a yellowish line at base.

*Expanse*.—41 mm.

*Habitat*.—St. Laurent, French Guiana.

*Type*.—Cat. No. 9572, U.S.N.M.

**COENIPETA ALBIDENTINA, new species.**

Primaries pointed; secondaries without marginal excavation; dark purplish brown, overwashed with violaceous; lines of the ground color, scarcely contrasted, coarsely crenulate, the transverse posterior cutting a large white patch resting on costa and reaching to middle of reniform; subterminal line pale crenulate edged, containing dark lunules of the ground color; a row of illy defined dark lunules near the margin. Hind wings brownish black, the outer line faint, dentate, pale, visible centrally, then narrower and slightly dislocated toward anal angle; fringe with a white apical and subapical spot. Below greyish, shading to black at apex of fore wings and outer margin of hind wings; white costo-discal spot of fore wings repeated, solid, elongated; hind wings with double dark discal arc and two mesial lines, the fringe of both wings irregularly spotted with white.

*Expanse*.—40 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9573, U.S.N.M.

**Genus TYRISSA Walker.**

**TYRISSA CAROLA, new species.**

Entirely dark umber brown, densely shaded with black; a series of very numerous fine black lines alternating with umber brown cross both wings, beginning on costa of fore wings and curving parallel to the lower part of the outer margin, continued directly over the hind wings; a hemispherical area resting on costa of fore wings close to apex is umber brown, traversed by a double subcostal black line; fringes crenulate, a black line at base and a dark line at base and tip of fringe. Below smoky brown, the lines repeated but more evenly curved and crenulate, a broad submarginal space uniformly brown, devoid of lines.

*Expanse*.—34 mm.

*Habitat*.—Rio Janeiro, Brazil.

*Type*.—Cat. No. 9574, U.S.N.M.

Genus *SORYGAZA* Walker.*SORYGAZA ACUTALIS*, new species.

Primaries elongate, strongly excavate on upper half of outer margin; brownish ocher with a lilaceous tint; orbicular a minute black dot; reniform a large round black spot, its center a little broken in pale; fringe dark brown preceded by a row of marginal dots, which show distinctly only at the excavation; a faint trace of transverse anterior line on inner margin. Hind wings yellowish white, the fringe a shade darker; a small dark round discal dot. Below whitish, the costa and fringe of fore wings shaded darker purplish; a small discal dot on both wings.

*Expanse*.—20 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9575, U.S.N.M.

Genus *NEOHERMINIA* Druce.*NEOHERMINIA CHISENA*, new species.

Light purplish brown; primaries with a dark brown shaded mark from costa subapically bent to pass over reniform, then obliquely to inner margin as a mesial shade, the outer part narrowly edged by a yellow line; reniform large, broadly ringed in pale yellow, filled with a narrow dark broken ring; orbicular a small pale yellow dot; transverse anterior line narrow, dark, obscure; a row of black marginal dots. Secondaries with two mesial dark wavy lines and a pale yellow submarginal one, all faint and visible distinctly only toward anal margin. Below the discal dots are repeated in dark brown, faintly pale ringed; the lines are only traces.

*Expanse*.—30 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9577, U.S.N.M.

Genus *BLEPTINA* Guenée.*BLEPTINA CANDALIS*, new species.

Brown, slightly bronzy, markings obscure; transverse anterior line dark, nearly straight; median shade visible below; reniform a minute pale yellowish speck; posterior line dark, linear, finely pointed dentate; submarginal line straight, slender, pale yellow, a little flexed over discal nervules; a row of small dark marginal dots. Secondaries a little less bronzy than primaries, with a faint dark mesial line. Below lighter, a submarginal pale line from costa of fore wings, continuous on hind

wings; a discal spot and mesial line on hind wings, relieved on the paler ground.

*Expanse*.—30 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9578, U.S.N.M.

**BLEPTINA CLARA, new species.**

Testaceous, the primaries with a red shade over median area; lines blackish; transverse anterior roundedly excurved below median vein; orbicular a small dot; reniform a large rounded blotch; transverse posterior line close to the reniform, deeply excavate-dentate, breaking into two rows of dots at the points of the dentations, the outer dots on the veins, the inner between, part above the reniform not dentate; submarginal line double, broken into shaded intravenular spots, the outer line running to apex, gently excurved centrally; a row of marginal black dots. Hind wings paler testaceous; a faint discal dot; a dark mesial line distinct on inner half; two faint shaded submarginal lines; a row of terminal black dots. Below shaded with reddish on costae of both wings, irrorate with blackish; large diffused discal dots, a common mesial band and two submarginal ones, all diffused and irrorate, but distinct; a row of terminal black dots as above.

*Expanse*.—24 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9579, U.S.N.M.

**BLEPTINA MARGOTALIS, new species.**

Greyish testaceous, brown irrorate median shade broad, dark brown, twice angularly waved; reniform broadly brown outlined, large; transverse posterior line incised crenulate, broken into two rows of dots; submarginal line wavy flexuous, pale, dark edged within; secondaries with two outer brown diffused bands. Below both wings with large discal spots and two outer lines, those of primaries faint, those of secondaries more distinct than above on the paler ground. (The type is faded and a little moldy.)

*Expanse*.—30 mm.

*Habitat*.—

*Type*.—Cat. No. 9580, U.S.N.M.

**Genus TORTRICODES Guenée.**

**TORTRICODES PAULENSIS, new species.**

Purplish brown, median space, except towards costa, dark chocolate brown; inner and outer lines straight, a little convergent towards costa, white, diffused, limiting the dark median space; a deep incision in outer margin almost to the outer line, with a fold and a yellowish

space at its base above. Secondaries greyish brown. Below greyish brown, the secondaries with a faint discal dot and outer line.

*Expanse*.—26 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9581, U.S.N.M.

**TORTRICODES DULCENA, new species.**

Very dark purplish brown; outer line pale, faint, limiting a dark brown shade in median space which fills the space irregularly, but is hardly relieved from the ground color, except next the outer line; submarginal line starts from costa subapically in a light yellowish apical shade, forms a long rounded projection and retreats behind the marginal incision, faintly traceable to inner margin; the projection is filled by a dark brown spot and a smaller one rests on the base on the incision with a slight reddish discoloration beyond. Secondaries black, a long elliptical white space over cell and below, relieving the median vein and origins of veins 2 and 3 as narrow black lines. Below primaries greyish, the apical testaceous space repeated, enlarged; secondaries as above, but grey irrorate, the white discal space encroached on by a dark discal dot.

*Expanse*.—27 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9582, U.S.N.M.

**Genus MEGACHYTA Grote.**

**MEGACHYTA NOLUALIS, new species.**

Light purplish brown: lines brown, fine, dentate, not much bent; a brown median shade from the dark cloudy reniform, which is centered by a slender pale yellow line; submarginal line starts in a pale yellow streak from costa, then becomes wavy and obscure, surrounded by a dark shade; a terminal black crenulate line. Secondaries with faint discal dot and dark outer line, the outer area darker shaded; submarginal line pale, diffused; terminal line as on primaries. Below paler, discal dot and dark mesial line and pale submarginal line repeated on both wings.

*Expanse*.—20 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9583, U.S.N.M.

**MEGACHYTA SABULAREA, new species.**

Primaries with the basal space blackish brown, twice indented; inner half of median space whitish grey; outer half of this space smoky brown, reddish, in an elliptical area representing the reniform; transverse posterior line black, coarsely dentate; subterminal space black-

ish brown, edged by whitish wavy subterminal line; terminal space grey, a blackish blotch below middle on outer margin, passing on to fringe; a terminal crenulate black line. Secondaries brownish grey, paler at base; two brown wavy lines on the inner margin. Below primaries dark, the subterminal pale line on costal half; secondaries pale, brownish powdered; a subbasal blackish line, discal dot, and two median lines which touch each other centrally; fringe spotted.

*Expanse*.—17 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9584, U.S.N.M.

Genus RHOSOLOGIA Walker.

**RHOSOLOGIA PALLIDA**, new species.

Primaries straw yellow, finely brown irrorate; secondaries paler at the base, shaded with blackish on costal half beyond cell. Below the blackish shading extends on fore wings also but is more diffused. The palpi and fore tibiae are blackish, otherwise straw yellow.

*Expanse*.—32 mm.

*Habitat*.—Rio Janeiro, Brazil.

*Type*.—Cat. No. 9585, U.S.N.M.

Genus ADROCAMPA Schaus.

**ADROCAMPA ATOMOSA**, new species.

Pale straw color, primaries rather sparsely irrorate with milky brown. Secondaries white, slightly irrorated with brown outwardly. Below white, the costal areas of both wings shaded and irrorated with brown, most so on primaries. The palpi are porrect, downcurved, reddish brown, darker below; antennae bepectinate except on apical fifth.

*Expanse*.—34 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9586, U.S.N.M.

Genus ARISTARIA Guenée.

**ARISTARIA ORIZABALIS**, new species.

Antennal tuft of male large, followed by three segments bearing long serrations. Dark umber brown, outer margin blackish shaded; reniform a large brown-black lunule; subterminal line wavy and excurved opposite the excurve of outer margin, pale yellowish, broken. Hind wings dark grayish, lighter at base; an outer pale submacular line parallel to margin. Below paler, especially base of secondaries, the outer pale line repeated, more diffused but not more distinct than above.

*Expanse*.—38 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9587, U.S.N.M.

**ARISTARIA PICATALIS**, new species.

*Female*.—Reddish brown; transverse anterior line dark, wavy, faint; median shade broad, oblique, sharply limited basally, fading out toward costa; reniform a black lunule constricted in two, set in a neat pale yellow ring; transverse posterior line excavate-dentate, broken into two rows of dots; subterminal line strongly excurved below the middle, scarcely wavy, pale reddish, surrounded by a dark brown clouding; a marginal crenulate dark line. Secondaries grayish, a faint discal dot and dark mesial line; outer line pale yellowish, narrow, submacular; a crenulate dark terminal line. Below grayish with common faint dark discal dots and mesial lines; outer line pale.

*Expanse*.—31 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9588, U.S.N.M.

**ARISTARIA TRINITALIS**, new species.

Umber brown, with markings nearly obliterate; transverse anterior line very faint, brown, slender, angled in the middle; a broad faint median discal shade; reniform pale yellow with two brown dots; a broad diffuse shade about the subterminal line which is composed of yellowish dots; a broken dark terminal line; secondaries grayish, dark, a still darker shade outwardly, through which runs a broken pale submarginal line. Below dark with a smoky outer line and broader submarginal one on secondaries, the latter followed by a faint broken pale line.

*Expanse*.—32 mm.

*Habitat*.—Trinidad, British West Indies.

*Type*.—Cat. No. 9589, U.S.N.M.

**ARISTARIA CONSPICUA**, new species.

Tuft of male antennæ very large; primaries with the outer margin prominently excurved above the middle; russet brown, shading to dark red-brown in median space and beyond; orbicular a white point; reniform a white circle with black center; transverse posterior line brown, dentate, set in a band of the light russet color; subterminal line fine, pale, narrow and nearly obsolete, followed at the excurve of outer margin by a large nearly pure white blotch; fringe russet with a brown crenulate terminal line. Hind wings blackish; fringe dotted with russet and with a black crenulate terminal line. Below grayish, reddish shaded along costa of primaries; fringes ornate as above; primaries with an outer dark diffused line and a submarginal narrow pale one, shown near costa only; secondaries with a large black discal spot preceded by a small dot; mesial line crenulate, blackish;

margin broadly shaded in blackish, cut by a wavy pulverulent pale submarginal line.

*Expanse*.—35 mm.

*Habitat*.—Rio Janeiro, Brazil.

*Type*.—Cat. No. 9590, U.S.N.M.

**ARISTARIA BOCANTIS, new species.**

Dark sooty brown, lighter narrowly just before the transverse anterior line and in outer half of median space, relieving the narrow crenulate posterior line; orbicular a minute white dot; reniform a faint, scarcely visible ringlet; subterminal line in the broad uniform dark outer field, strongly wavy, pale yellowish, narrow and broken into illy connected dots; fringe checkered with pale. Secondaries blackish brown with very faint pale wavy mesial and outer lines. Below dark, discal dots, dark outer and pale submarginal lines, indicated only on primaries, relieved more distinctly on secondaries by a broad pale shading over the disk below costa.

*Expanse*.—34 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9591, U.S.N.M.

**ARISTARIA RICALIS, new species.**

Dark grey-brown, the lines narrow, wavy denticulate, except the transverse anterior which is straight, oblique from above orbicular toward base, dark, set in an ochereous shade; this shade proceeds outward along costa to posterior line; orbicular a round white dot; reniform a large white kidney-shaped ringlet; a broad oblique dark median shade; subterminal line pale; fringe checkered with pale. Secondaries of the color of primaries with discal dot and two dark wavy lines edged without with paler. Below costa of primaries with a testaceous shade, secondaries light grayish except at margin; dark discal ringlets on both wings and a common dark mesial line; a common submarginal pale wavy line.

*Expanse*.—28 mm.

*Habitat*.—Costa Rica.

*Type*.—Cat. No. 9592, U.S.N.M.

**ARISTARIA AZTECALIS, new species.**

Light brown, slightly testaceous, the lines obsolete, powdery, broken; the transverse anterior shows some powdery patches on both margins; reniform two small dots in a slightly paler area; subterminal line broken into yellowish dots in a narrow blackish cloudy border; terminal line crenulate, faint. Secondaries paler toward base; blackish on outward border; a subterminal submaculate pale line. Below

blackish outwardly; subterminal pale line repeated; a faint dark discal dot and mesial line on secondaries.

*Expanse*.—35 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9593, U.S.N.M.

**ARISTARIA STOLALIS**, new species.

Dark grayish brown; lines narrow, dark, denticulate; orbicular a minute yellow point; reniform pale, obscure; a median shade; subterminal dark, with minute yellowish intravenular specks on the denticulations; a terminal row of cusps with yellow specks in the concavities. Secondaries dark, lighter on each side of the mesial line; a dark discal spot; a row of pale submarginal points. Below lines repeated as usual, the disk of secondaries lighter.

*Expanse*.—25 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9594, U.S.N.M.

Genus **RENIA** Guenée.

**RENIA ORDENALIS**, new species.

Light brownish testaceous, lines obscure; median shade narrow, fairly distinct below; reniform of two superposed points; transverse posterior line excurved over cell, sharply indentate opposite middle of reniform, denticulate below, narrow, dark, a little expanded opposite cell; subterminal faintly indicated in dark scales; a terminal row of points. Secondaries paler toward base; a faint pale submarginal line. Below the lines repeated but faintly, the discal dot and mesial line dark, the submarginal line pale, showing only on the secondaries.

*Expanse*.—26 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9595, U.S.N.M.

**RENIA CACALIS**, new species.

Light testaceous brown; transverse anterior line narrow, dark, twice waved; orbicular a yellowish point; reniform a yellow lunule with a dark brown margin outwardly; posterior line crenulate-dentate; subterminal diffused, strongly waved, dark yellow, preceded by a dark red-brown shade and followed by a blackish which reaches margin on discal nervules; a terminal row of black dashes. Secondaries a little paler at base; traces of a discal dot; two mesial and a submarginal dentate dark lines with a yellowish space between the last two; termen as on fore wings. Below the lines repeated in the usual manner, a discal dot on both wings and common pale dentate submarginal line.

*Expanse*.—24 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9596, U.S.N.M.

**RENIA BIPUNCTALIS**, new species.

Size and markings of *Aristaria aztecalis* Schaus, but the antennal tuft farther out, being at about the 22d joint instead of the 16th, and the terminal joint of palpi not more than half as long. The lines are more distinct, the transverse anterior traceable, fine, dark; a broad dark median shade running to reniform; reniform of two dots in a yellowish space; posterior line coarsely denticulate, slender, dark.

*Expanse*.—36 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9597, U.S.N.M.

**Genus PALTHIS** Hübner.**PALTHIS GNOMA**, new species.

Primaries purplish brown; transverse anterior line visible below cell, very slender, black, straight, oblique, strongly angled on median vein; orbicular a round blackish dot; reniform a very faint pale ellipse; transverse posterior line oblique from outer fourth of costa to middle of inner margin, straight white, slender, narrowly black edged within, followed by a broad brown shade; subterminal line wavy, slender, brown; a fine terminal crenulate black line, followed by a pale line at base of fringe. Secondaries reddish brown, paler at base; a faint mesial pale line and marginal rufous dilution; a black crenulate terminal line. Below reddish suffused with a trace only of lines; terminal black lines repeated.

*Expanse*.—25 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9598, U.S.N.M.

**PALTHIS BERTHALIS**, new species.

Palpi upturned, the third joint very long, even, with a large hair pencil on the inner side. Head, thorax, and basal space of primaries dark brown; primaries pale yellowish to subterminal line, the marks obsolete, a trace of the median shade appearing; orbicular a black dot; reniform two superposed dots; transverse posterior line slender, brown, shortly followed by a brown shade, then a pale lilaceous white shade to subterminal, containing a round black spot subapically; terminal space yellowish brown; a terminal row of black dots. Secondaries whitish with bands centrally; a short mesial brown discoloration with narrow dark line, followed by a longer marginal violaceous stripe, cut by a submarginal whitish line. Below pale testaceous, the subapical dark spot of primaries, discal dot, outer line and submarginal spottings of secondaries indicated in brown.

*Expanse*.—22 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9599, U.S.N.M.

**PALTHIS CALCALIS**, new species.

Outer margin of primaries with a prominent angle: purplish brown, dark, lines not well defined; transverse anterior dark wavy; a dark median shade; reniform a narrow reddish lunule with brown edge; subterminal line wavy, pale yellowish, broken; a terminal row of brownish dots. Secondaries pale at base, dark at margin; a mesial dark line, clouded; a submarginal pale line cutting the dark area. Below the disk of secondaries paler, the lines very faintly repeated, on the primaries the submarginal forming a row of reddish blotches, distinct and enlarged opposite the subapical incision.

*Expanse*.—23 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9600, U.S.N.M.

**Genus MASTIGOPHORUS** Poey.**MASTIGOPHORUS PANDES**, new species.

Male palpi recurved, long enough to reach to end of abdomen. Dark purplish brown, lines blackish, not strongly relieved; transverse anterior shaded; median shade from reniform to margin; posterior slender, irregularly denticulate; subterminal irregular, broadly shaded inward; reniform a dot, orbicular a narrow lunule, both dark yellow; marginal dots small. Secondaries nearly as dark as primaries; discal dot round, blackish; mesial line dark; submarginal pale, cutting the darker marginal area. Below the lines faintly repeated on a paler ground, especially those of secondaries.

*Expanse*.—28 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9601, U.S.N.M.

**MASTIGOPHORUS LINEATA**, new species.

Male palpi reflexed, long enough to reach to end of thorax. Dark brown; transverse posterior lines straight, white, darker edged with-out; two subapical blackish spots preceded by a slender whitish line, the remains of the obsolete subterminal; anterior line slender, pale, straight; reniform a narrow yellowish lunule; a terminal row of small dashes. Secondaries greyer with an outer pale line which defines a dark line from the marginal shade; it approaches the margin toward anal angle and is bent and intensified there with a brown dot in and one following the bend; a faint discal dot. Below primaries dark over disk with a dark outer and yellowish submarginal lines costally; secondaries white, brown irrorate; discal dot and broken mesial line dark.

*Expanse*.—23 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9602, U.S.N.M.

Genus *BATYMA*, new genus.

Palpi upturned, the second joint reaching vertex, the third long and slender, erect; legs moderate, slender, smoothly scaled. Hind wings with vein 5 distinct, from near lower angle of cell.

*BATYMA ONESALIS*, new species.

Outer margin with a sharp angle on both wings. Primaries angled in the middle sharply, but slightly; pale lilaceous brown, the space beyond posterior line solidly and contrastingly dark brown; transverse anterior line straight, oblique, defined by a darker outer edge, obsolete on costa; a dark shade from base to middle of cell; orbicular pale, diffused; a narrow median shade below cell, parallel to anterior line; reniform a slender lunule, dark without, narrowly yellowish within; posterior line straight, pale, very narrowly brown edged within, defining the dark marginal shade, which begins in a dark brown band followed by blackish spottings, then lilaceous brown to margin: a terminal crenulate black line joining spots; fringe interlined with yellowish and dark brown. Secondaries with a small angle near tornus; pale at base with a mesial shaded brown line; outer margin broadly purplish shaded, although not solidly, limited inwardly by a dark shaded band between a faint yellowish outer mesial line and central traces of a brown denticulate submarginal one; fringe as on fore wings. Below both wings shaded in patches with rusty brown, the disk of primaries blackish, a dark discal lunule and shaded outer line; secondaries with outer and submarginal crenulate diffused dark lines.

*Expanse*.—28 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9603, U.S.N.M.

*BATYMA FRANCALIS*, new species.

Primaries dark brown, washed with purplish white over basal, inner half of median and subterminal spaces; anterior line straight, dark; reniform an oblique, compressed, white ringlet, the pale color following from its apex nearly to apex of wing; posterior line narrow, pale, waved; subterminal whitish, slightly wavy, forming the outer edge of the pale subterminal space; a row of terminal dark dots; fringe uniformly dark. Secondaries brown; mesial line pale, dark edged within, visible only on inner half; outer line pale, likewise abbreviated; termen and fringe as on fore wings.

*Expanse*.—20 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9604, U.S.N.M.

**Genus ILSEA, new genus.**

Antennæ bipectinate; eyes large, naked; palpi upturned, the second joint erect, compressed, close-scaled, third about twice as long as wide, erect; hind tibiae enlarged, with a long hair pencil. Hind wings with vein 5 from close to lower angle of cell, 3, 4 separated by an equal distance.

**ILSEA BORMIA, new species.**

Dark brown, the lines obliterate; orbicular an irregular white mark; reniform large, constricted, white ringed, pale brown filled; posterior line faintly shown, double, dark; subterminal blotched with white, dentate wavy, situated rather near the margin. Secondaries with the outer margin crenulate, colored like primaries; discal dot an irregular white mark, followed by a more brownish tint; faint double mesial and submarginal blackish bands, obsolete toward costa, the submarginal running to anal angle where it is rather distinct. Below diversified, with whitish ground and dark irrorations; reddish shades about the white discal spots more contrasted than above; outer lines repeated, black, the subterminal of primaries blotched in white as above.

*Expanse*.—30 mm.

*Habitat*.—Petropolis, Brazil.

*Type*.—Cat. No. 9605, U.S.N.M.

**Genus COSCAGA, new genus.**

Antennæ simple with long bristles; labial palpi upturned, third joint small; maxillary palpi long, porrect, four times as long as head, bearing a long hair pencil on inner side; legs long and slender with long spurs. Hind wing with vein 5 near lower angle of cell, 3 and 4 shortly stalked.

**COSCAGA ANGULATA, new species.**

Dark brown, the long pencil of palpi yellowish white. Primaries dark brown; anterior line slender, brown, arcuate, angled on submedian; median shade very broad, sharply limited within, diffused without, dark brown; reniform two contiguous angled dark brown spots; posterior line slender, dentate-crenulate, breaking into a row of dots and an inner line; subterminal line strongly angled opposite the marginal excurve, pale, cloudy brown edged on both sides; terminal line faint, crenulate. Secondaries grayish brown with a faint dark arcuate mesial line. Below nearly immaculate, traces of lines only.

*Expanse*.—27 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9606, U.S.N.M.

## Genus OCALARIA, new genus.

Antennæ bipectinate, the tips simple; palpi very long, the second joint porrect, four times as long as head, the third joint slender, terete, as long as second joint; legs long and slender, spurs long. Wings rounded, hind wings with vein 5 from lower third of discocellulars.

## OCALARIA GUARANA, new species.

Both wings broad and rounded; dark brown; a round black discal ocellus on primaries, white pupiled, rufous ringed, situated apparently between the orbicular and reniform, which are both absent; lines both broad, white, diffused and broken centrally, the posterior gently excurved over cell; subterminal wavy pale, narrow, and almost broken; an apical black ocellus, white pupiled, broadly rufous ringed; pale dots at base of fringe. Secondaries with pale reniform discal ringlet, mesial wavy and submarginal dentate whitish lines; fringe as on fore wings. Below powdered with pale, the markings repeated, including the two ocelli of fore wings.

*Expanse*.—27 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9607, U.S.N.M.

## Genus NICETAS Druce.

## NICETAS PAULOZA, new species.

Dark brown; ordinary lines nearly obsolete, denticulate; median shade faint and narrow; subterminal pale, wavy, and denticulate, in a darker clouding; orbicular a little pale dot in a black ring; reniform with the upper half absent, the lower half a rounded rufous spot with a smeared black edge; a row of minute terminal dots. Secondaries nearly the color of primaries and almost unmarked, the subterminal line showing faintly pale. Below the disk of hind wings lighter, the usual markings better relieved.

*Expanse*.—36 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9608, U.S.N.M.

## Genus HYPONEUMA, new genus.

Eyes moderate, naked; palpi porrect, the second joint four times as long as head, tapering, third joint slender, down-curved, compressed, the pair divaricate; antennæ with long cilia; legs moderately long with long spurs. Hind wing with vein 5 fairly strong, from middle of discocellulars.

**HYPONEUMA LEUCANIOIDES, new species.**

Primaries square at apex; straw yellow, brownish shaded, lines obsolete, the wing finely streaked with rows of brown scales longitudinally with a few black ones scattered between the veins; orbicular and reniform small, black, elongate punctiform; an irregular row of black spots outwardly; terminal points black. Secondaries grayish tinted: a blackish discal dot and terminal points. Below blackish powdered especially on primaries, the marks of secondaries repeated more distinctly.

*Expanse*.—32 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9609, U.S.N.M.

**Genus HYPENA Schrank.****HYPENA ORONALIS, new species.**

Head and thorax dark brown. Abdomen and secondaries dull gray-brown. Primaries brown, strongly violaceous, and irrorated thinly with dark brown scales; inner line faint, darker brown, slightly curved; outer line fine, reddish brown, shaded with dark lilacine, angled beyond cell, then wavily oblique to inner margin, where it is outwardly edged with white; a white spot on it at vein 2: reniform lunular, dark lilacine; outer margin darker brown, obliquely limited from apex to vein 4; an indistinct row of subterminal black spots: a terminal dark line; fringe grey-black. No spots underneath.

*Expanse*.—28 mm.

*Habitat*.—Bolivia.

*Type*.—Cat. No. 9610, U.S.N.M.

**Family PYRALIDÆ.****Genus ARGYRACTIS Hampson.****ARGYRACTIS CINERALIS, new species.**

Dark cinereous, the primaries uniform with but a trace of markings; a whitish dilution near base, one centrally, and a faint diffused broadly sinuous outer line. Secondaries white, the margin cinereous; a grey discal lunule from which a mesial band runs to anal angle.

*Expanse*.—Female, 25 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9611, U.S.N.M.

**ARGYRACTIS GUADARENSIS, new species.**

Primaries nearly solidly suffused with grey on a whitish ground, the discal mark a narrow, somewhat oblique white lunule; a dull reddish shade on the middle of the inner margin curves over toward anal angle,

inclosing a whitish washed space; a white subapical dash from costa directed toward margin; a submarginal line, white apically, metallic silvery below; terminal space filled in with yellow between these lines. Secondaries whitish in the submedian fold and anal margin, elsewhere suffused with grey; a large yellow extra discal patch; outer area with the usual dark speckling transformed into a brown nuclear band, retracted from the terminal marks by a pure white space; six subconfluent deep black marginal spots, separated by violaceous metallic scales on the inner side, joined by dark grey in the middle and divided by yellow specks at the margin.

*Expanse*.—Female, 31 mm.

*Habitat*.—Guadalajara, Mexico.

*Type*.—Cat. No. 9612, U.S.N.M.

**ARGYRACTIS HERMINALIS, new species.**

Primaries nearly solidly suffused with grey, the white ground appearing partially along the inner margin; a small white costal bar at middle; discal mark oblique, yellow, preceded and followed by scattered pale blue metallic scales; a large curved yellow mark before anal angle; a white subapical dash closely followed by a yellow line that curves inward below the end of the dash nearly to discal mark; subterminal line white above, silver grey below; terminal line yellow; fringe dark grey; some metallic blue scales near anal angle. Secondaries grey suffused except in submedian folds and base of cell; a yellow extra-discal mark followed by a dark grey bar; then a line of pale blue metallic scales; then another yellow band, above which are two slender wavy dark lines running nearly to apex, separated by yellowish; a marginal brownish black band on upper half of outer margin, cut into on its inner edge by irregular whitish spottings, but not divided into spots nor intensely black and not ornamented with metallic scales.

*Expanse*.—Female, 24 mm.

*Habitat*.—Guadalajara, Mexico.

*Type*.—Cat. No. 9613, U.S.N.M.

**ARGYRACTIS JALAPALIS, new species.**

Very similar to *A. quadarensis* Schaus, but only half the size. Primaries brown dusted on white, the markings the same as *quadarensis* except for a faint whitish bar at middle of wing on inner margin. Secondaries as in *quadarensis*, but the metallic bar has a more pearly, less bluish luster, and there is a greater infiltration of yellow in the subapical marking.

*Expanse*.—Female, 17 mm.

*Habitat*.—Jalapa, Mexico.

*Type*.—Cat. No. 9614, U.S.N.M.

**ARGYRACTIS CYLOIALIS, new species.**

Very similar to *A. guadarensis* Schaus, and of the same size. The primaries have a mesial whitish line across the wing, which is not defined in the type of *guadarensis*, and there is a stronger infiltration of yellow in the outer portion of the wing, the yellow being also of a lighter tint; it is especially apparent in the light rounded area before tornus, where it forms a broad arc. Secondaries as is *guadarensis*, with the metallic band duplicated by scales outside the second yellow mark; more infiltration of yellow subapically; the marginal black spots more rounded and concrete, appearing as three rather large spots fused to an olivaceous black margin and half circled on the inner side by white, limited from the white area within by an irregular black lunular line.

*Expanse*.—30 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9615, U.S.N.M.

**ARGYRACTIS SINITALIS, new species.**

White, washed with grey-brown, the white predominating mesially; a slender wavy mesial white line across wing; discal mark outlined by two approximate brown cusps; submarginal line white, brown edged, very sinuous, nearly touching outer margin at lower third; marginal line yellow, preceded centrally by a white dash. Secondaries brown at base, a broad white shade mesially followed by brown; two dark streaks running to apex, the whole submarginal area with blackish irrorations; marginal black spots defined by metallic bluish scales, united by dark brown outwardly, set in a pale yellow field, which is limited inwardly by a slender black line.

*Expanse*.—20 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9617, U.S.N.M.

**Genus CATACLYSTA Hübner.****CATACLYSTA JALISCALIS, new species.**

Primaries brownish grey; a nearly straight mesial white line; preceded centrally by an orange-red patch; lower half of space beyond white powdered with brown; two conspicuous white costal dashes converging toward tornus, separated below by orange-red; a dash of this color obliquely inward from tornus, followed above by a short white shade which joins the inner dash; scattered metallic scales at tornus. Secondaries brown irrorate at base; an antemesial orange-red band; followed by a narrow white line with metallic scales on it; outer area, including the discal dot, thickly covered with black specks; a narrow, pure-white area before the round, black marginal

spots which are large and joined outwardly by black with patches of metallic scales; only a trace of yellow color on the extreme margin.

*Expanse*.—21 mm.

*Habitat*.—Guadalajara, Mexico.

*Type*.—Cat. No. 9616, U.S.N.M.

**CATACLYSTA ORIZABALIS, new species.**

Similar to *Argyractis guadarensis* Schaus and *A. jalapalis* Schaus. It is smaller than the former and differs in having the whitish mesial line visible for its lower half, the inner costal streak straighter and placed nearer the apex. It is a little larger than the latter, darker than the type specimen, but with the same markings.

*Expanse*.—Female, 20 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9618, U.S.N.M.

**CATACLYSTA SCARALIS, new species.**

Rich dark brown, bronzy shaded; a white subbasal dilution; a slender mesial white line, excurved above, followed by a white dilution on costa and above inner margin; a slender irregular white outer line, starting subapically, sending a loop to near outer margin at lower third, then returning close to costa and again returning obliquely to outer fourth of inner margin; a subterminal spotted white line; a black terminal line; fringes with small white spots. Secondaries dark brown, slight traces of a whitish submarginal line centrally. Body dark, a white band on the third abdominal segment.

*Expanse*.—Female, 18 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9642, U.S.N.M.

**Genus OLIGOSTIGMA Guenée.**

**OLIGOSTIGMA DUCALIS, new species.**

Body gray, the thorax whitish centrally with a dark stripe behind the collar and one at base of abdomen. Wings shining white; primaries with the costa gray-dusted; a broad brown-black stripe from base to apex, slightly narrowing; a similar slender stripe from before tornus parallel to outer margin, diminishing to a point before apex; a marginal orange-red line; fringe dark. Secondaries with a dark band at base, another submarginally; terminal line as on fore wings, but broader, edged with black on both sides; three little black dots in the base of fringe subapically.

*Expanse*.—20 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9619, U.S.N.M.

## Genus CYMORIZA Guenée.

## CYMORIZA PAROALIS, new species.

Ocherous, diluted to whitish next to the lines; subbasal line brown, wavy; an extra-basal brownish ocherous shade line; inner line brown, angled on subcostal, else straight; outer lines irregular, starting on costa at apical fourth roundedly excurved and retreating to reniform, which it outlines, then to inner margin, slightly inflexed below median vein; marginal line dark yellow, edged by a fine dark line which is preceded by a narrow white space. Secondaries with subbasal, outer mesial and submarginal brown lines, shading inward and defined outwardly by paler shading; marginal ornamentation as on primaries.

*Expanse*.—16 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9620, U.S.N.M.

## CYMORIZA JONESALIS, new species.

Primaries with a subapical excavation; shining white, marked with broad orange ocherous, brown-black edged bands which largely occupy the wing and leave the ground color to appear in spots as follows: three small ones in basal space, an anterior band narrowing to costa, a transverse elliptical spot in submedian space outwardly and one above it beyond cell, an outer half band from costa to median, a submarginal band. Secondaries with a strong subapical notch and a large one at anal angle, causing the angle to be retracted; marked as fore wings; white spaces, a basal band, furcate at margin, two mesial spots, the inner lunate, the outer semielliptical; two submarginal spots, the apical rounded triangular, the mesial lunate, fitted in between the subapical and anal incisions.

*Expanse*.—19 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9643, U.S.N.M.

## Genus PARAPONYX Hübner.

## PARAPONYX DIANALIS, new species.

White; primaries with a brown dot on inner margin near base, a black dot on submedian farther out, two black dots for reniform with a brown one below; posterior line faint, brown, wavy; a brown shade subapically; a row of black cusps near the margin. Secondaries with blackish discal dot; a wavy mesial broken brown line; a brown patch subapically and at inner angle; a row of black cusps as on fore wing.

*Expanse*.—17 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9621, U.S.N.M.

**PARAPONYX PAULALIS, new species.**

White, shaded with brown before all the lines; basal space brown filled toward costa; a mesial brown line, angled on median, preceded by a white area, before which is a brown shade; reniform a white lunule outlined by two brown lines; posterior line indicated on costa and margin by a dark line; a broad brown suffused subterminal shade; a terminal yellow line, preceded by a narrow brown one; black terminal dots. Secondaries with vague brown bands near base, an irregular mesial and gently curved outer, slender, brown lines; margin with a brown band containing some metallic scales and a narrow yellow terminal line with brown scales on the extreme margin.

*Expanse*.—18 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9644, U.S.N.M.

**Genus AULACODES Guenée.****AULACODES MORALIS, new species.**

White, shaded with yellowish brown; inner line white, angled on median, defined by yellowish within above and brown below without, the basal space containing a brown patch on inner margin; outer line irregular, narrow, white, starting on costa at apical fourth, running outward to subterminal line, then returning to costa around reniform and back again to inner margin near tornus, angled on submedian; the loop is outwardly filled with yellowish, a patch of black scales in place of the reniform; a yellow-brown subapical triangular spot; a submarginal white line, the margin yellow-brown with black terminal edge. Secondaries with two short mesial diffused bands; a broad submarginal band centrally with rounded ends; marginal band as on fore wings, the fringes white, interlined with a row of brown spots.

*Expanse*.—16 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9645, U.S.N.M.

**AULACODES TEMPLALIS, new species.**

Primaries white, largely covered by the yellow-brown marks; base mottled with this color; inner line broad, brown, angled on median, joined by a bar to the outer line, which is likewise broad; it starts from costa at outer fourth, makes a loop around reniform, and curves to inner margin; subterminal line yellow-brown, dark edged, broad, bent in a compressed loop up to and including reniform; terminal line yellow, brown edged. Secondaries with two basal yellow-brown bars, inner and outer mesial brown bands rather widely separated, flexuous in opposite directions; a broad yellow band nearly fills the subterminal

space, brown edged, brown irrorate; terminal yellow line broad and containing four quadrate black spots with white pupils, running from the subapical incision to above anal angle; fringes dark.

*Expanse*.—16 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9646, U.S.N.M.

**AULACODES CONFUSALIS, new species.**

With the pattern of markings of the preceding species and the following differences: the brown markings are expanded, reducing the white areas to narrow lines; all the markings are broadly yellow centered, reducing the brown to narrow bordering lines; the subterminal band in its upcurve to reniform is constricted, nearly defining a separate reniform spot. On the secondaries the two mesial bands are brown and become confluent centrally; the marginal markings hardly differ in the two species.

*Expanse*.—14 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9647, U.S.N.M.

**AULACODES PAMPALIS, new species.**

Lustrous brown, yellowish tinted, nearly unicolorous; the lines can be traced faintly, whitish, narrow, with dark edges, occupying the positions of the white bands of the two preceding species, of which this is a further development in the same direction. Secondaries shaded in brown, leaving three whitish bands which correspond apparently to the edges of the dark lines of the other species, the third band being submarginal; a narrow marginal dull yellowish area with brown edge on each side, but without any development of ocellate spots.

*Expanse*.—Female, 19 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9648, U.S.N.M.

**Genus NYMPHULA Schrank.**

**NYMPHULA FRANCISCALIS, new species.**

Primaries grey-brown, thickly dusted on a white ground that is completely obscured except to a lens; median area darker, limited by the mesial and outer lines white are obsolete, the outer forming a rather large outcurve over cell. Secondaries white, a marginal brownish line toward apex. Head and thorax of the color of fore wings, white below the eyes.

*Expanse*.—Female, 20 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9649, U.S.N.M.

## Genus PARTHENODES Guenée.

## PARTHENODES BERTHALIS, new species.

Ground color shining white; primaries shaded with brown along costa, before mesial line and in a submarginal band; inner line brown, slender, near base; mesial line narrow, blackish, broken, separated within by a narrow white space from a broad brown shade-band; outer line reduced to a small oblique blackish bar on inner margin; reniform a brown ringlet; submarginal shade-band strongly angled inward on submedian; a marginal yellow line, narrowly edged with black. Secondaries with traces of mesial line and on the margin traces of black spots, which consist of four groups of black scales with a faint tint of yellowish about them, preceded and followed by a scattered line of black scales.

*Expanse*.—Female, 22 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9650, U.S.N.M.

## Genus MACALLA Walker.

## MACALLA PARANENSIS, new species.

Palpi and body creamy brown; primaries creamy brown on basal half with dark spot on costa and a few blackish dots below, dark brown outwardly; raised scales in cell light within, dark without; lines obsolete, the surface somewhat mottled, the submarginal showing as a series of light points on the veins, preceded and followed by slender black lines; a marginal black line; fringe light with dark checkerings. Hind wings whitish, the apex fuscous, traces of a submarginal line above; a marginal black line.

*Expanse*.—Male, 32 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9622, U.S.N.M.

## MACALLA ALBESCENS, new species.

Primaries greenish brown, irrorate with black scales; mesial line pale, running into a large white blotch on inner margin, with a broad brown-black shade before and a narrow black line beyond above the blotch; an oblique black discal bar; outer line wavy, pulverulent, ill defined, followed by a white shade; a terminal row of black dots. Secondaries white, stained with grey at apex and narrowly along outer margin for the upper half.

*Expanse*.—35 mm.

*Habitat*.—

*Type*.—Cat. No. 9651, U.S.N.M.

Genus *JOCARA* Walker.*JOCARA APICALIS*, new species.

Olivaceous brown, rather dark; palpi and thorax luteous and dark brown shaded. Primaries squamose with diversified but ill-defined shades, reddish brown along center of inner margin; mesial line pale, diffused; outer line submarginal, rather distinct, pale, dark edged within, bluntly dentate outwardly, gently excurved over the lower discal nervules; a white blotch on outer margin at apex irrorate with reddish scales; a row of black terminal dashes; fringe lighter above at the blotch. Hind wings whitish, soiled grayish, relieving a pale submarginal line which retreats inward subapically; costa and apex darkly shaded; a black marginal line; fringe, especially along inner margin, roseate tinted.

*Expanse*.—Female, 31 mm.

*Habitat*.—Orizaba, Mexico.

*Type*.—Cat. No. 9623, U.S.N.M.

Genus *DEUTEROLLYTA* Lederer.*DEUTEROLLYTA PAGIROA*, new species.

Thorax dark gray with whitish scales intermixed, palpi and antennal process shaded with luteous; primaries luteous, broadly so along inner margin, shaded with olivaceous brown centrally except along costa in mesial space; a pale speck in cell and slight dark discal dot; submarginal line finely dentate, pale, retreating from margin apically; a terminal row of black dashes. Secondaries whitish, apex broadly dark grey, running along outer margin narrowly; blackish points on the veins submarginally centrally.

*Expanse*.—29 mm.

*Habitat*.—Castro, Parana, Brazil.

*Type*.—Cat. No. 9652, U.S.N.M.

Genus *PYRALIS* Schrank.*PYRALIS GARALIS*, new species.

Head and thorax dark brown; primaries luteous brown, irrorate with dark; inner line dark, angled on submedian and vein 1, obsolete above; a black point for orbicular; a round dark spot for reniform, slightly kidney shaped; outer line wavy above, slightly excurved over cell, incurved below, incised on submedian and excised on vein 1; a terminal row of dark dashes. Secondaries subpellucid, grayish luteous, shading dark at apex; traces of an outer line; terminal dashes as on fore wings but fainter.

*Expanse*.—20 mm.

*Habitat*.—São Paulo, Brazil.

*Type*.—Cat. No. 9624, U.S.N.M.



## DESCRIPTIONS OF SIX NEW SPECIES OF FISHES FROM JAPAN.

By DAVID STARR JORDAN and ALVIN SEALE,  
*Of Stanford University, California.*

The species noted in the present paper were obtained in Japan in 1900, by Professors Jordan and Snyder.

The accompanying drawings are the work of Mr. William S. Atkinson.

### Family CYPRINIDÆ.

#### PHOXINUS SEPTENTRIONALIS Jordan and Seale, new species.

Head, 3.75 in length (without caudal); depth, 4.50; eye, 3.50 in head; snout, 3.50; D. 9; A. 11; interorbital area, 3, wider than eye; scales about 70. Teeth, 2, 5.

Body oblong, moderately compressed; snout evenly rounded; depth of caudal peduncle, 3 in head; mouth small, with thin lips; no barbels;

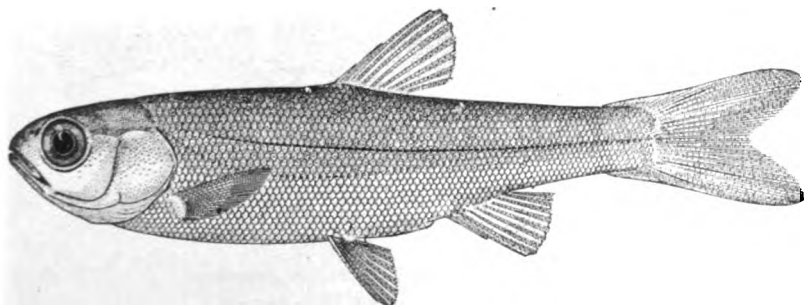


FIG. 1.—*PHOXINUS SEPTENTRIONALIS*.

maxillary scarcely reaching front of eye; gill-rakers short and flat, 8 on lower limb; lateral line extending abruptly downward and backward to above middle of pectoral, ceasing near the middle of body.

Origin of dorsal midway between front of eye and base of caudal, the longest ray, 1.50 in head; ventrals inserted under front of dorsal; pectoral equal to postorbital part of head; caudal forked, 1.20 in head.

Color, in spirits, yellowish white; a narrow but distinct dark line on side from middle of caudal anteriorly to first third of body; fins all pale.

Twelve specimens of this minnow were obtained in a small stream at Aomori, in northern Japan. Length, 1.70 inches.

*Type*.—Cat. No. 53411, U.S.N.M.

*Cotypes*.—No. 9257, Stanford University.

**LEUCISCUS CÆRULESCENS** Sauvage.

Of this species, originally described from Lake Biwa, we have two examples from Kawatana, near Nagasaki. These were overlooked in the review of Japanese Cyprinidæ by Jordan and Fowler.<sup>a</sup>

**RHODEUS ORYZÆ** Jordan and Seale, new species.

Head, 3.75 in length (without caudal); depth, 2.50; eye, 2.75 in head; D. 10; A. 12; pharyngeal teeth, 5, hooked; scales, 11–32; lateral line sloping downward and backward to above or somewhat behind ventrals, where it ceases.

Body deep, compressed; snout short, shorter than eye, which is equal to interorbital width; mouth small, the maxillary not reaching

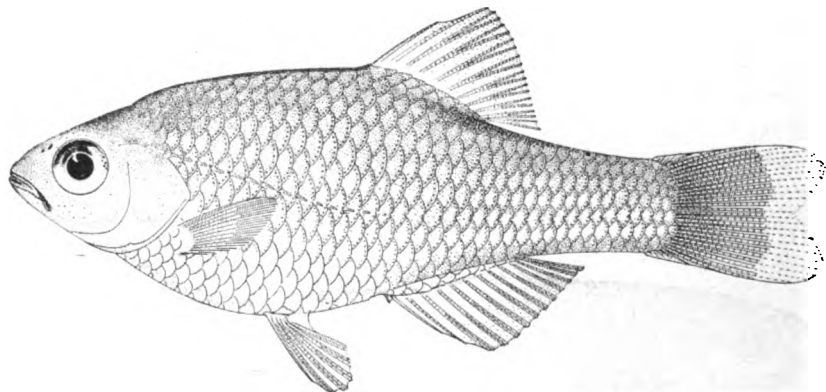


FIG. 2.—*RHODEUS ORYZÆ*.

front of eye, its tip with a distinct barbel; scales firm; front of dorsal nearer snout than base of caudal; ventrals below tip of pectoral, which is 1.35 in head; caudal about equal to head.

Color, in spirits, yellowish; the margins of the scales above, slightly darker; a dark stripe from nuchal region to front of dorsal; a golden shade on opercle; fins yellowish, unmarked.

Seven specimens, the largest an inch long, were taken in a ditch in a rice field at Kawatana, northwest of Nagasaki, in the island of Kiu-siu, in Japan. It is found in company with the small Cyprinodont, *Aplocheilichthys latipex*, which it somewhat resembles. This species is

<sup>a</sup>Proc. U. S. Nat. Mus., XXVI, 1903, p. 845.

related to the Chinese *Rhodeus ocellatus*, and both seem to belong to the European genus, *Rhodeus*.

*Type*.—Cat. No. 53412, U.S.N.M.

*Cotype*.—No. 9258, Stanford University.

**SAYONARA** Jordan and Seale, new genus.

The genus *Sayonara* is related to *Anthias*, and may be thus characterized:

Body robust, covered with ciliated scales; lateral line complete, running high, its tubules simple; maxillary and jaws scaly; no supplemental maxillary; no teeth on pterygoids or tongue; preopercle serrated, without plectroid spines; gill-rakers short; dorsal notched, the spines ten, all low, first and last short; no filamentous rays; pectorals long, unsymmetrical, the rays branched; ventrals slightly before pectorals; caudal fin convex.

*Type*.—*Sayonara satsumæ*.

**SAYONARA SATSUMÆ** Jordan and Seale, new species.

Head, 2.30 in length (to base of caudal); depth, 2.80; eye, 4.80 in head; snout, 4; D. X, 15; A. III, 7; scales, 33.

Body rather short, not greatly compressed; depth of caudal pedun-

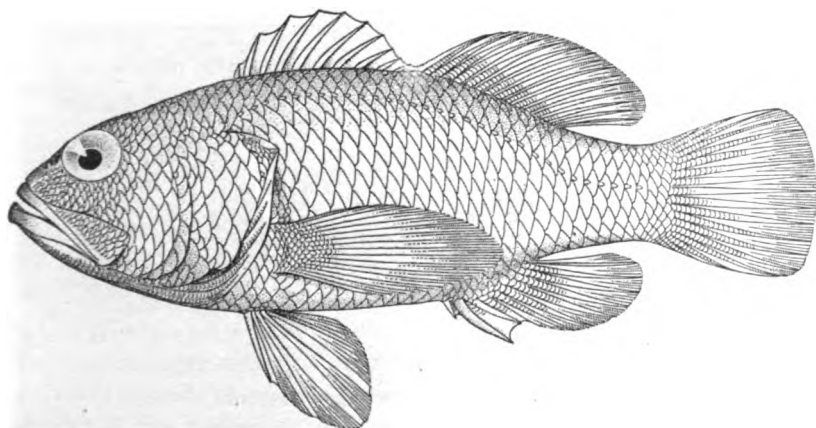


FIG. 3.—*SAYONARA SATSUMÆ*.

cle 2.90 in head; mouth large, the maxillary extending to below posterior margin of eye, its distal breadth 1.50 in eye; minute teeth on jaws, vomer, palatines, none on pterygoids or tongue; upper jaw with four enlarged teeth; gill-rakers short and blunt, 7 + 10, the five outermost, above and below, rudimentary; maxillary, lower jaw, and forehead scaly; no supplemental maxillary bone; preopercle and lower margin of interopercle and preopercle evenly serrated; no plectroid spines on preopercle; opercle with three short, flat spines, scales large, ciliated, equidistant, the middle one largest, lateral line complete, running high; tubules short, simple. Soft rays scaly at base.

Front of spinous dorsal slightly in advance of pectorals, the spines low; the third slightly longest, 3.75, in head; the fourth and fifth similar, the others gradually shorter to the tenth, the higher eleventh being a soft ray; soft dorsal higher, the longest ray, 2.10 in head; base of soft dorsal, 1.75 in head; longest anal ray, 2.30 in head, its base, 1.25 in the longest ray; second anal spine the longest and strongest, slightly greater than length of snout; pectoral very long, unsymmetrical, its lower rays extending to middle of anal, 1.20 in head; the rays branched; origin of ventrals slightly before upper axil of pectorals, their tip reaching nearly to vent, their length, 1.70 in head; caudal rounded, 1.60 in head.

Color, evidently bright red in life. In spirits, yellowish white, with about three very indistinct whitish longitudinal stripes on side; fins pale, unmarked.

One specimen, 6.25 inches long, No. 9259 Stanford University, was taken at Yamagawa, in the province of Satsuma, near Kagoshima, by Dr. Kakichi Mitsukuri, by whom it was presented to Stanford University.

**STELGISTRUM MORORANE** Jordan and Seale, new species.

Head, 2.75 in length (without caudal); depth, 4; eye, 3.50 in head; D. IX-16; A. 11; scales 38; a row of about 28 modified toothed scales along base of dorsals.

Head large; snout pointed, equal to eye; mouth rather large, the

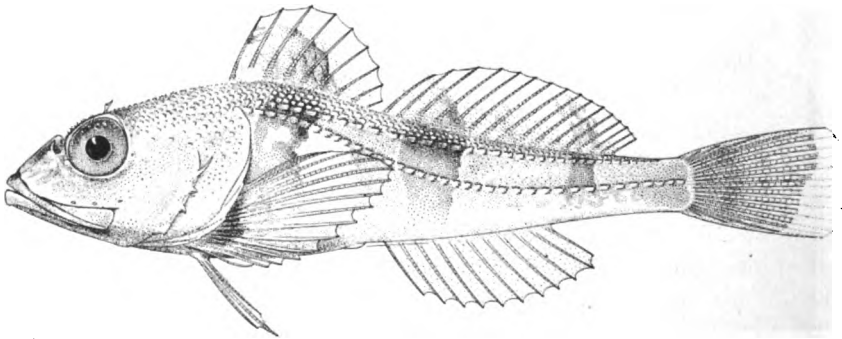


FIG. 4.—*STELGISTRUM MORORANE*.

maxillary extending to below posterior third of eye; jaws even; bands of minute teeth on jaws and vomer, none on palatines; preopercle with 4 rather small spines, the upper and longest curved upward, the second directed backward, the others downward and forward; opercle roughened but unarmed; four large pores on under jaw; gill-rakers reduced to blunt, prickly processes, 7 on lower limb; mucous pores about eye large and distinct; head roughened with small prickles.

Origin of dorsal above axil of pectoral; fourth dorsal spine longest, 2.75 in head; pectoral, 1.30 in head; ventrals slightly before pectorals, 2 in head; caudal, 1.75 in head.

Color, in spirits, yellowish white, with three wide brown bands which extend over back and obliquely forward on sides; a dusky blotch at base of caudal; a distinct brownish blotch on lower part of base of pectoral; fins uniform pale.

One specimen, 1.25 inches long, No. 9260, Stanford University, was dredged in the harbor of Mororan, island of Hokkaido.

**RHINOGOBIUS NAGOYÆ** Jordan and Seale, new species.

Head, 3 in length (without caudal); depth, 6.20; eye, 5 in head; D. VI-9; A. 10; scales 35.

Body moderately elongate, compressed; depth of caudal peduncle, 2.85 in head; snout, 2.75 in head, rather rounded and depressed; depth of head, through pupil 2.40 in its length; greatest width, 1.50;

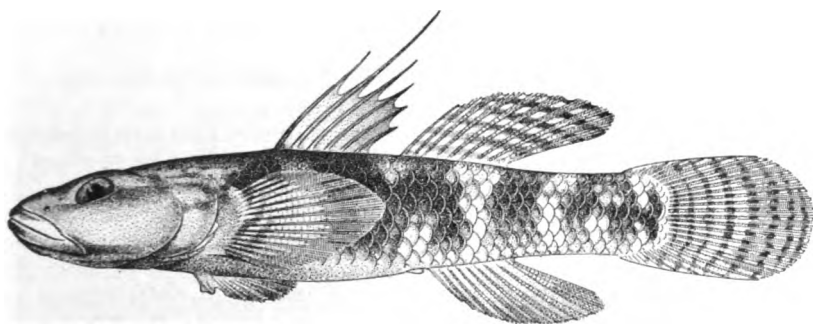


FIG. 5.—*RHINOGOBIUS NAGOYÆ*.

cheeks and opercles naked; nuchal region naked; interorbital space narrow about twice pupil; mouth large, the maxillary reaching front of orbit; jaws with three rows of short curved teeth; tongue rounded; gillrakers short and thick, 10 on lower limb; dorsal with the first four spines elongate and filiform, the longest, 1.10 in head; posterior rays of soft dorsal longest, 1.50 in head; longest anal ray, 1.75; pectoral, 1.30 in head, none of the rays silk like; ventrals, 2.20 in head; caudal rounded, 1.50 in head.

Color, in spirits yellowish, with about 5 rather indistinct vertical brown bars wider than the interspaces; two lines at base of pectoral; spinous dorsal slightly clouded with bluish; soft dorsal with four longitudinal stripes; caudal with 8 vertical brown bars, the one at base shorter, wider, and darker colored than the others; anal white, clouded with bluish, pectoral and ventral white.

One specimen, 2.55 inches long, No. 9262, Stanford University, was sent from Nagoya, Japan, by Professor Keinosuke Otaki.

**CALLIONYMUS KITAHARÆ** Jordan and Seale, new species.

Head, 3.55 in length (without caudal); depth, 9; eye, 2.50 in head; D. IV-9; A. 9; snout, 3 in head.

Preopercular spine with four curved hooks on upper side, and a spine turned downward and forward at base; distance from tip to tip of preopercular spines equal to length of head; depth of head equal to diameter of orbit; head pointed anteriorly; mouth small, with small teeth; gill-opening a small aperture at upper edge of opercle.

Dorsal spines low, the first or longest scarcely greater than eye, the

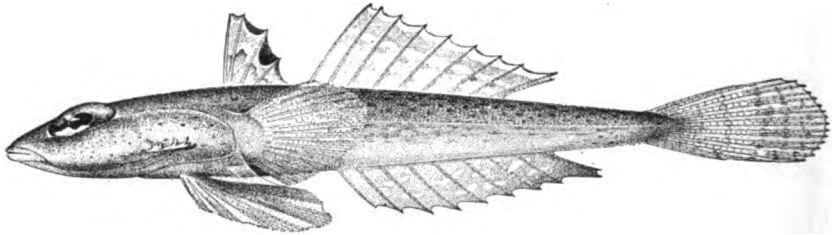


FIG. 6.—*CALLIONYMUS KITAHARÆ*.

fin triangular in form, the other spines gradually shortened; pectoral 1.40 in head; ventrals, 1.50 in head; caudal pointed, 1.10 in head.

Color, in spirits, uniform slaty brown, a shade paler on nuchal region; fins colored like the body.

A single specimen, No. 9261, Stanford University, 1.50 inches long, was taken in the harbor of Nagasaki. It resembles *Callionymus beniteguri*, but seems to be distinct. It is named for Mr. T. Kitahara, of the Imperial Bureau of Fisheries.

## NEW AMERICAN PALEOZOIC OSTRACODA.

### NOTES AND DESCRIPTIONS OF UPPER CARBONIFEROUS GENERA AND SPECIES.

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By EDWARD O. ULRICH,<sup>a</sup>

*Geologist, U. S. Geological Survey,*

And RAY S. BASSLER,

*Assistant Curator, Department of Geology.*

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The first article of this series of papers was published by Mr. Ulrich in 1900,<sup>b</sup> when species of *Ctenobolbina* and *Kirkbya* were described. Since that time Mr. Bassler has joined Mr. Ulrich in the study of these organisms and they now hope to publish papers upon this subject more frequently. Their aim in these papers will be to publish illustrations and descriptions of new families, genera and species, as well as notes upon those already established, leaving the classification and definition of the higher groups until a future time, when the fossil ostracoda can be made the subject of a monograph. All of the specimens figured in this article are in the collections of the United States National Museum.

### Superorder OSTRACODA.

Family LEPERDITELLIDÆ, new family.

Genus PARAPARCHITES, new genus.

*Leperditia* (part) of authors.

Carapace small, 1 mm. to 2 mm. in length, leperditoid or subovate in shape; surface smooth, sometimes with a small tubercle or spine in antero-cardinal third of each valve; right valve with ventral edge rabbeted so as to slightly overlap the simply beveled edge of the left valve; dorsal edges of valves usually unequal, the left slightly the

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<sup>a</sup>Published by permission of the Director of the U. S. Geological Survey.

<sup>b</sup>Jour. Cincinnati Soc. Nat. Hist., XIX, 1900, pp. 179-185.

more prominent and commonly overlapping the right or receiving its edge in a shallow groove.

*Type of genus.*—*Paraparchites humerosus*, new species.

This genus is established for the reception of the majority of the Carboniferous and Devonian ostracoda that hitherto have been referred to the genus *Leperditia*. The writers, however, are satisfied that the genetic relations of these species are not with the Ordovician and Silurian types of *Leperditia*, but rather with the group of species for which Jones proposed the name *Aparchites*. True species of *Leperditia* always attain a much greater size and their tests have a characteristically black color that is never present in the group of species for which the name *Paraparchites* is here proposed. The latter are further distinguished from *Leperditia* by the character of the ventral overlap of the valves, which is not simple but effected by means of a groove in the edge of the right valve into which the beveled edge of the left valve is received. The relation of the dorsal edges of the valves is also different in the two groups of species, the edges meeting evenly in *Leperditia* while in *Paraparchites* the back of the left valve commonly projects more or less beyond that of the right valve, and in most cases contains a groove just over the straight hinge line into which the edge of the right valve is inserted.

As expressed above and indicated by the proposed name, *Paraparchites* is regarded as closely related to and probably derived from *Aparchites*. In the latter, however, the ventral edges of the valves meet without appreciable, or, at any rate, constant overlap, and it is this difference that is chiefly relied on in distinguishing the two genera. Otherwise the general aspect of the carapace is very similar in the two groups of species, the shape and size being about the same, while the dorsal inequality of the valves is at least simulated in certain Ordovician species of *Aparchites* (e. g., *A. elliptica* Ulrich).

*Paraparchites* is doubtless closely related also to *Leperditella*, an Ordovician genus, the principal difference now recognized being that the ventral overlap is reversed in the two genera, the right valve overlapping in the former and the left in the latter. The inter-relations of these two genera and *Aparchites* are intimate, while their alliances with other types of ostracoda are such as to indicate a distinct family with characteristics that in a considerable degree at least are intermediate between those of the Leperditidiæ and the Beyrichiidiæ. Like the latter family, the Leperditellidæ, as the new family may be called, were probably derived from some early Ordovician member or members of the Leperditidiæ, but the general or average expression of the new family is more like that of the simple types of the Beyrichiidiæ. In the opinion of the writers, further, the peculiar late Paleozoic to recent genus *Cytherella* was derived from *Paraparchites* or some related genus, and hence from the Leperditellidæ.

## PARAPARCHITES HUMEROSUS, new species

Plate XI, figs. 1-4.

Length of large example, 1.8 mm.; height of same, 1.25 mm.; thickness of same, 1.05 mm. Carapace subovate, with the outline slightly angulated in the antero-dorsal region; surface rather strongly convex, with greatest thickness near middle of valves. Left valve with dorsal edge straighter than in right valve, the edge in the latter being convex in outline and thickened so that it projects above the hinge line of the left valve. Ventral edge of carapace thick and slightly channeled on each side of the constant line between the valves.

This species is distinguished from all known American Carboniferous species referable to this genus, and from those from British rocks described by Jones and Kirkby as of *Leperditia*, except their *L. compressa*, in the more ovate outline of its carapace. The valves of *L. compressa*, however, are much less convex, especially in the middle parts, so that its carapace presents a very different outline in edge views when compared with the comparatively evenly convex profiles presented in corresponding views of *P. subovata*. In all the other Carboniferous Leperditidiæ the dorsal line is straighter and one or both of the dorsal angles much better defined.

On account of the thickening of the dorsal edge of the right valve and the rounding of the outline thereby produced, this valve may be mistaken for valves of *Cytherella* like *C. richteriana* Jones and Kirkby and *C. inflata* Jones and Kirkby.

*Formation and locality.*—Abundant in the Elendale formation, Manhattan, Kansas, and in yellow shales of the Wreford limestone, 6 miles west of Reece, Kansas. The species occurs also in forms generally a little inferior in size to the Manhattan specimens, very abundantly in the Permo-Carboniferous deposits of Texas, notably in certain dark shaly limestone, on Mustang Creek, east of Ballinger.

*Cotypes.*—Cat. Nos. 35627, 35657, U.S.N.M.

## NOTES ON CARBONIFEROUS BEYRICHIIDÆ AND KIRKBYIDÆ.

The Carboniferous ostracoda that have been referred by authors to the genus *Beyrichia* are divisible primarily into two unequal groups. One of these, which of the two accords the more nearly with the Silurian genotypes of the genus, has equal valves; the other, which contains more species, has unequal valves, the left being the larger. The first group embraces species like *B. ? radiata* Jones and Kirkby, an American example of which is here figured. In this and the other species of this group, the surface of each valve presents but two rounded nodes, one larger than the other. The smaller node is situated behind the median sulcus and well down toward the base of the dorsal half of the valve. The larger node is placed more or less in

front of the center of the valve and generally its base extends farther up toward the dorsal edge and not infrequently reaches it.

Strictly speaking, these bituberculated species are not congeneric with the original Silurian types of *Beyrichia*. The latter have three nodes or lobes—a central one, usually the smallest and corresponding to the posterior (smaller) node in these Carboniferous species, a larger anterior lobe, and a posterior one that, like the anterior lobe, is generally developed into an incurving ridge. This posterior node is not developed in the bituberculated group of species in question, and as this group contains many species and represents a well-marked stage in the development of the Beyrichiidae, a distinct generic arrangement seems advisable. However, on account of the present uncertainty respecting the limits of such related and not well-established genera as *Beyrichiopsis*, *Beyrichiella*, and *Synaphe*, and, more especially, because it may become desirable to modify the definition of the similarly bituberculated genus *Ulrichia* so that it shall include them, it is deemed advisable to defer proposing a new genus until comparisons now in progress may be completed. It may be well to mention also that the writers have in manuscript descriptions of two late Silurian species from Maryland, having unquestionable affinities to *Beyrichia*, in which the lobation of the valves is reduced to two small, ill-defined, subcentral swellings situated on either side of a well-developed primitive sulcus.

Though variable in what are usually to be regarded as important respects, the next following species, which belongs to the larger, inequivalved group, still seems to conform in essential particulars to the British species upon which Jones and Kirkby founded not only one but three genera, namely, *Beyrichiopsis*,<sup>a</sup> *Beyrichiella*,<sup>b</sup> and *Synaphe*.<sup>c</sup> Besides, a number of species that can scarcely be distinguished generically from either *Beyrichiella* or *Synaphe* are described by the same authors as true Beyrichiæ. Careful comparisons show that the permanent as well as the variable features of the lobation of the valves is so nearly the same in all these inequivalved forms that the present writers are inclined to doubt the necessity of more than two, instead of four, distinct genera. Indeed, if the whole assemblage were referred to a single comprehensive genus, with perhaps two or three subgenera, the arrangement would have advantages over the present classification. If the latter suggestion were adopted, *Beyrichiella* would be the main genus, *Synaphe* would drop out as a synonym, and *Beyrichiopsis* would be the subgeneric designation for the fringed species. A second subgenus, if found desirable, might then be erected for the group of species of which *Beyrichia fidicata* Jones

<sup>a</sup> Geol. Mag., 3d Dec., III, 1886, p. 434.

<sup>b</sup> Idem, p. 438.

<sup>c</sup> Carboniferous Ostracoda from Ireland, Sci. Trans. Roy. Dublin Soc. (2), VI, 1896, p. 190.

and Kirkby is one extreme, and *Beyrichiella bolliiformis* Ulrich and Bassler is the other.

The recognition of *Synaphe* as a synonym of *Beyrichiella* simplifies the nomenclature of the Ostracoda, since this name has been used previously for a genus of Coleoptera<sup>a</sup> and again for a genus of Lepidoptera.<sup>b</sup> Cossman in 1899<sup>c</sup> proposed the new name *Kirkbyia* to replace *Synaphe* Jones and Kirkby, thereby adding to the confusion since the two names *Kirkbyia* Cossman and *Kirkbya* Jones are practically identical.

It is to be regretted that reviewers who are always on the lookout to supplant old names with coinages of their own can not take the time to go into the subject at least thoroughly enough to spare the student further trouble.

In all these unequivocal Carboniferous Beyrichiidae the lobation is, as has been stated, essentially the same. Normally it consists of a rather constant round node situated behind (according to Jones and Kirkby's orientation of the valves it would be in front of<sup>d</sup>) the median sulcus and a larger lobe situated on the other side of the sulcus and generally nearer the dorsal edge. These nodes are susceptible to considerable variation, not only in different species, but also among individuals of one and the same species. In the most simple types, considered either as species or individuals, the valves resemble *Primitia*, they being marked by nothing further than a median dorsal sulcus. That they have no true relation to *Primitia*, however, is shown at once by the fact that the Carboniferous types in question have unequal valves, in which feature they agree with contemporaneous lobate forms whose alliances with *Primitia* are therefore obviously remote.

In less simply constructed valves the postmedian lobe is separated by a more or less impressed vertical sulcus from the broader swelling that occupies the greater part of the posterior half in the most simple types. In the further differentiation of the surface contour of the valves the antero-median lobe is similarly separated. These separations are faintly indicated in figure 18 on Plate XI, which represents about the maximum of lobation attained in *B. gregaria*. In the very

<sup>a</sup>*Synaphe* J. Thomson, Syst. Ceramb., 1864, p. 60.

<sup>b</sup>*Synaphe* Jacob Huebner, Verzeichniss bekannter Schmetterlinge, 1816, p. 347.

<sup>c</sup>*Kirkbyia* Cossman, Revue Critique de Paleozoologie, III, 1899, p. 45. "*Synaphe* Kirkby 1897. Crust. Triple emploi avec *Synaphe* Hubn. Lepid. 1816, et Thoms. Coleopt. 1864, sans compter deux *Synapha* ou *Sinapha*. Je propose de le remplacer par *Kirkbyia*, Cossman."

<sup>d</sup>Jones and Kirkby seem to have relied uniformly upon the relative thickness of the ends of the carapace in deciding which is the right and which the left valve, the thicker end being always called the posterior. The present writers, on the contrary, seek to identify corresponding nodes in related genera and species, and thereby hope to attain, first, consistent orientation, and, finally, a more natural classification of the Beyrichiidae.

similar British species, *Beyrichia arcuata* (Bean) Jones and Kirkby, the large anterior lobe seems never to be divided, but in certain other forms found in the Carboniferous rocks of England, notably *Beyrichia fastigiata* Jones and Kirkby and *B. fodicata* Jones and Kirkby, the lateral sulci are deeper, and in the latter of the two species mentioned the separation and definition of the dorsal lobes reached an extreme stage. Perhaps an even greater degree of contour differentiation is shown in Jones and Kirkby's *Beyrichia tuberculospinosa*, in which the ventral swelling that is usually a conspicuous feature in these Carboniferous Beyrichiidae is broken up into three sharply defined nodes.

These various modifications of surface contour often remind strongly of very diverse earlier Paleozoic generic types. The resemblance of the simplest forms to *Primitia* has been mentioned already. Those in the next stage, like *Beyrichia arcuata* (as figured by Jones and Kirkby), *B. craterigera* Brady, *Beyrichiopsis simplex* Jones and Kirkby, and *Beyrichiella gregaria* Ulrich and Bassler, are strikingly like *Klædenia*; and the seeming importance of this resemblance in lobation is heightened by the fact that both have similarly unequal valves. Fortunately, however, in the true *Klædenia* it is the right valve that overlaps the ventral edge of the left, while in these Carboniferous forms the opposite is the case. Another type, described here as *Beyrichiella bolliiformis*, is singularly like certain Ordovician and Silurian species of *Bollia* (e. g., *B. pumila* Ulrich); but, like the other Carboniferous species under consideration, this has unequal valves, a condition that does not occur in a true *Bollia*. Further, while in the earlier Paleozoic *Bollia* the diagnostic "loop" is a very constant feature, comparisons of numerous examples of the *Beyrichiella* show that the loop which connects the nodes in this species is most variable and in some instances is not to be distinguished at all.

How to explain these seeming diverse alliances is no easy matter. Still it is believed the explanation lies in the fact that the Beyrichiidae had entered the period of their extinction in Carboniferous times. Under such conditions it is reasonable to assume that the type was undergoing degeneration, and that this took place in the usual manner. It may be suggested, therefore, that the resemblances to earlier stages in the development of the family above noted were occasioned by reversion or by arrested development, whereby former immature stages were retained through the adult stages, and thus became the permanent specific and perhaps generic characteristics of the respective types. Whether all the inequivalved Carboniferous Beyrichiidae were derived from one or two survivals of the earlier types of the family, or whether the suggested reversions affected similarly many such survivals, is a point that it may not be possible to determine satisfactorily. Still it is believed that careful comparisons between the Devonian and Carboniferous representatives of the family will throw much light upon

the matter, and it is hoped that such studies may finally result in a satisfactory classification of the species.

The relations of the Carboniferous Beyrichiidae under consideration to *Kirkbya* are more apparent than real. At the best they rest on resemblances exhibited by what may be justly regarded as aberrant species of *Kirkbya* (e g., *K. tricollina*), or by species whose true characters and generic alliances have been misinterpreted. *K. annectens* of Jones and Kirkby (1866) is such a species. In 1896, however, the same authors made it the type of a new genus. Recognizing the resemblance shown by *K. annectens* to such widely different types as *Primitia*, *Kirkbya*, *Ulrichia*, *Drepanella*, and *Beyrichiopsis*, they proposed to distinguish it under a name "indicative of its connective character, viz, *Synaphe*." The studies of the present writers tend, in the manner already set forth, to support the observations of the British authors except that part which refers to the alliance of *Synaphe* with *Kirkbya*. The latter genus, namely, seems not to be genetically related to *Synaphe*, representing, in the writers' opinion, a distinct family that was distinguished nearly or quite as early as the true Beyrichiidae. The Kirkbyidae, as the family may be called, had its inception in such early Ordovician ostracoda as *Macronotella*. Other Ordovician and Silurian genera that should be referred to the new family are *Moorea* and *Placentula*.

As to the genus *Kirkbya*, as now understood, it doubtless is susceptible of subdivision, if indeed it may not be divided into two and perhaps three equally good generic groups. Restricting the genus to species conforming in general shape and markings to the genotype *K. permiana* Jones—a species of which in passing it may be remarked is much like the Ordovician *Macronotella*—it is evident that the trinodate forms, such as *K. tricollina* Jones and Kirkby and *K. centronata* of the present paper, are worthy of a separate generic designation. These nodate forms at first sight suggest intimate generic relations to Beyrichiidae, but it seems to the writers as more likely to be a case of mere similarity in final development. However, pending the conclusion of the detailed comparisons now in progress, it has seemed advisable to defer the suggested restriction of the genus to a more fitting opportunity.

Finally, of all the Paleozoic ostracoda, the Kirkbyidae only seem to afford the stock from which the great family Cytheridae might have been derived. Several Silurian species have been referred to *Cythere* by Jones, but it seems highly improbable that any of these is strictly referable to that genus. The same might be said of certain Carboniferous species described by Jones and Kirkby. *Cythere* ? *haworthi* of this article is one of three species in the United States National Museum that nearly fill the requirements. Though rather obviously allied to Kirkbyidae, they are most probably Cytheridae, but whether true *Cythere* can not be decided now.

## Family BEYRICHIIDÆ.

## Genus BEYRICHIA McCoy.

## BEYRICHIA ? RADIATA Jones and Kirkby.

Plate XI, fig. 5.

*Beyrichia radiata* JONES and KIRKBY, Ann. and Mag. Nat. Hist. (5), XVIII, 1860, p. 257, pl. VIII, figs. 1, 2a, 2b.

Length 1.06 mm., greatest height 0.67 mm., greatest thickness about 0.5 mm.

Valves somewhat oblique, hinge line long and straight, anterior end rounded and denticulate, posterior margin obliquely truncate, surface of valves with two rounded tubercles situated on the dorsal half, one on either side of a central depression, the anterior tubercle much larger than the posterior one. Small papillæ arranged somewhat scatteringly over the entire surface. A wide free rim or flange, often marked more or less obscurely with radiating lines, overhangs the ventral and posterior borders of the valves. Usually this rim is delicate and nearly flat, but with age it thickens and sometimes, as in the specimen illustrated, the postventral part presents a swollen appearance.

The Kansas specimens referred to this species differ in no essential respect from some of the British examples figured by Jones and Kirkby. In the specimen here figured the radial lines on the flange are very obscure, but this condition is satisfactorily accounted for by the obviously senile state of the example.

*Formation and locality.*—Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

*Plesiotype.*—Cat. No. 35633, U.S.N.M.

## BEYRICHIA ? EMACIATA, new species.

Plate XI, fig. 6.

Length 1.10 mm., height 0.68 mm.

Size, shape, and general expression about as in *B. ? radiata*, but has an emaciated look, the surface of the valves between the nodes being more sunken and the ventral portion much less tumid though ridged. A short, vertical curved ridge in the post-dorsal angle and a rim-like border along the straight back and anterior end. The flange or frill, which is bent outward at the edge, is not so wide as in *B. ? radiata*. Surface finely punctate.

With only separated valves adhering to shale it was not possible to decide whether they are equal or overlapping. If equivalved, the species belongs to the same genus as *B. ? radiata*; if inequivalved, then it would be an unusual form of either *Beyrichiella* or *Beyrichi-*

*opsis*. The former condition is regarded as the more likely to prove true.

Unless it is the same as White and St. John's *Beyrichia fetoidea*, which the writers have so far failed to identify, none of the known American species are sufficiently like *B. ? emaciata* to be easily mistaken for it. It is quite distinct also from all of the British species described by Jones and Kirkby.

*Formation and locality*.—Yellow shales in the Wreford limestone, 6 miles west of Reece, Kansas.

*Holotype*.—Cat. No. 35632, U.S.N.M.

Genus BEYRICHIELLA Jones and Kirkby.

BEYRICHIELLA GREGARIA, new species.

Plate XI, fig. 18.

Length 0.95 mm., height 0.58 mm.

Valves subelliptical in outline, the hinge line nearly straight and equaling in length about four-fifths of the longest diameter of the carapace, the cardinal extremities rather obtusely angular, the two ends subequal and rounding regularly into the ventral margin. The latter part of the outline varies in different specimens, being distinctly convex in some (as in the figured example) and quite straight in the middle third in others. Except the portion of the main vertical sulcus, which is well marked and located a little behind the center of the dorsal half, the surface markings exhibit considerable variation. The sulcus may be narrow with a broad swelling on either side, as in the figured specimen, or it may be wider, the increase being at the expense of the smaller (posterior) swelling. In the former case the posterior lobe is commonly divided medially by a faint vertical sulcus, the two sulci and two intervening nodes giving an appearance that reminds us of the Silurian genus *Klædenia*. The large anterior lobe rises abruptly from the median sulcus and is always the most prominent part of the valve. Usually a small spine, occasionally of larger size than in the figure, rises from the antero-dorsal slope, while a faint vertical sulcus is sometimes distinguishable just behind the spine. A large, ill-defined, longitudinal swelling generally occupies the lower middle part of the valves, while beneath this a more or less obscure depression sets off a ventral marginal flattening or flange. This marginal flange increases in width with age, young examples which then expose the denticulated contact edge of the valve, being without it. Although entire specimens have not been seen, the characters of the separated valves leave no doubt that the left valve is the larger and overlaps the ventral edge of the right.

No American species with which this might be confused has been described. Compared with British species only *Beyrichia ? arcuata* (Bean), as figured by Jones and Kirkby, seems near enough to require

care in discriminating between them. *B. gregaria* is proportionally higher, the anterior end especially being wider. The lobing of the valves seems to be rather more variable in the Kansas species, while no mention of the antero-dorsal spine is to be found in descriptions of *B. ? arcuata*.

*Formation and locality*.—Extremely abundant on bedding planes of clayey limestone bands of the Upper Carboniferous at Kansas City, Missouri.

*Holotype*.—Cat. No. 35625, U.S.N.M.

**BEYRICHELLA BOLLIAFORMIS, new species.**

Plate XI, figs. 7, 8.

Length 0.87 mm., height 0.52 mm., thickness 0.35 mm.

Carapace rather elongate subovate, the posterior end wider and more oblique than the anterior; cardinal angles obtuse; ends nearly equal in thickness. Surface of valves with two rounded and not very prominent nodes, subcentrally situated, one on either side of the deep median sulcus; nodes generally connected by a more or less obscure loop; posterior node rather better defined though smaller than the anterior. Ventral part of valves swollen without being definitely ridge-like. Dorsum channeled; ends and ventral edge, especially of the left valve, distinctly rimmed. Ventral edge of left valve overlapping that of the right.

The two nodes with the connecting loop impart an appearance strongly suggestive of certain species of *Bollia*. The "loop" is sometimes well defined, but in other examples it is scarcely distinguishable. The species evidently is closely related to *Beyrichia fodicata* Jones and Kirkby and *B. fastigiata* Jones and Kirkby, but its valves are relatively shorter and margined by a distinct rim, a feature not observed on the British species.

*Formation and locality*.—Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas. The same species occurs in the Upper Carboniferous deposits in Baylor and other counties in north central Texas.

*Holotype*.—Cat. No. 35631, U.S.N.M.

**BEYRICHELLA BOLLIAFORMIS TUMIDA, new variety**

Plate XI, figs. 9 to 11.

The form which it is proposed to designate provisionally as above differs from the typical variety of the species in two particulars, (1) the outline is somewhat rhomboidal, the anterior border being oblique, beginning to curve backward just beneath the antero-dorsal angle, and (2) the anterior third of the valve within the rim is much more tumid, this portion of the carapace being indeed decidedly thicker than the posterior part and generally exceeds even the middle thickness. Occasionally, as shown in fig. 10, the antero median node is obsolete.

It is thought possible that this variety may indicate merely a sexual phase of *B. bolliaformis*. Supposed female individuals of a number of Silurian and Devonian species of *Beyrichia* are known, but in these the tumidity is larger and much more sharply defined, and it occurs, not on one of the ends, but always on the ventral side of the valves.

*Formation and locality*.—Associated with, but apparently never so abundant as, the typical form of the species in Kansas and Texas.

*Cotypes*.—Cat. No. 35630, U.S.N.M.

Family KIRKBYIDÆ, new family.

Genus KIRKBYA Jones.

KIRKBYA PINGUIS, new species.

Plate XI, figs. 13 to 15.

Length 0.64 mm., height 0.37 mm., thickness 0.38 mm.

Carapace rather small, thick, suboblong, ends blunt in edge views, nearly equal and rounded in a side view; antero-cardinal angle obtuse, the posterior angle quite indistinguishable, ventral margin gently convex, the central portion nearly straight; dorsal outline straight in the anterior half and slightly convex in the posterior half, the latter part of the back being slightly impressed at the hinge line. Surface of valves with a subcentrally situated, rather small, and only moderately prominent node, and behind this, with a small sulcus intervening, two less conspicuous nodes placed one above the other, the larger of the two being near the post-cardinal angle. Free margins with a narrow but well-defined flat rim. Surface of test neatly reticulated, with small meshes. The diagnostic Kirkbyan "pit" is small and situated very near the center of the valve on the ventral slope of the median node.

This small ostracod is not very closely related to any described species. *K. oblonga* Jones and Kirkby and *K. lindahli* Ulrich are probably the nearest, but both are considerably larger while the valves of the former are without either nodes or a sulcus.

*Formation and locality*.—Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

*Holotype*.—Cat. No. 35629, U.S.N.M.

KIRKBYA CENTRONOTA, new species.

Plate XI, figs. 16, 17.

Length of a large example 0.82 mm., height 0.50 mm., thickness 0.50 mm.

Carapace oblong subquadrate, with thick flattened edges, a long, straight back, and rather sharp cardinal angles, the posterior angle the less sharp of the two. Valves with a prominent large rounded node situated very near the middle of the dorsal half. On either side of this a smaller elevation surmounted by a thin curved vertical ridge in old examples. The marginal ridge, which likewise is well devel-

oped only in old specimens, is directly over the hinge but runs more or less within the free edges. Test reticulated, the pattern moderately fine. Free margins, ridges, and surface ornament all arranged more or less obviously in a concentric manner. "Pit" of moderate size though readily distinguished from the meshes of the surface ornament, situated at the base of the median node and very near the center of the valve.

Fully developed and perfect examples present a very distinctive aspect. The concentric thin ridges and general form recall the Silurian *Strepula concentrica* Jones, but taking into account only the more essential characters, the true alliances of the species are readily apparent. These are doubtless with *Kirkbya tricollina* Jones and Kirkby, a species originally described from the Lower Carboniferous limestone of Great Britain and since found in the Birdsville formation of the Chester in the Mississippi Valley. It also has 3 nodes on each valve, but the central one is smaller and the lateral ones are not ridged, while the valves are thinner and without the marginal ridge found on *K. centronata*.

*Formation and locality*.—Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

*Holotype*.—Cat. No. 35628, U.S.N.M.

### Family CYTHERIDÆ.

#### Genus CYTHERE Müller.

#### CYTHERE ? HAWORTHII, new species.

Plate XI, fig. 12.

Length 0.48 mm., height 0.29 mm.

Valves rather strongly convex, very slightly oblique, the posterior half a trifle wider than the anterior; dorsal edge long and straight, cardinal angles distinct without being sharp; ends descending rather abruptly from the extremities of the hinge, but curving broadly enough below into the ventral edge. Just behind and a little above the center of the valves is a sharply defined and prominent round node; another tubercle, more like a blunt spine and smaller, is situated near the antero-cardinal angle. A third wing-like prominence marks the posterior half of the ventral slope. Finally, a small swelling may be observed at the post-cardinal angle. Nothing like a sulcus was observed. Surface of test punctate, the punctæ being arranged in somewhat oblique longitudinal lines descending posteriorly. No pit, nor is there a sign of a marginal rim.

This minute ostracod is probably not a true *Cythere*, but its general aspect suggests more of that family than of *Kirkbyidæ*. It is associated with one or two other, apparently congeneric, species, while still other forms of the same general type occur in the Upper Carboniferous deposits of Texas. These should all be subjected to careful

study before a definite generic arrangement is attempted. Specifically, *C. ? haworthi* is distinguished by the ventral wing-like prominence.

*Formation and locality.*—Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

*Holotype.*—Cat. No. 35658, U.S.N.M.

### Family BAIRDIIDÆ.

Genus BAIRDIA McCoy.

BAIRDIA BEEDEI, new species.

Plate XI, figs. 19, 20.

Length 1.22 mm., height 0.75 mm., thickness 0.52 mm. Carapace thick, short, subrhomboidal in outline, lanceolate in edge views, the point of greatest thickness being near the middle; overlapping dorsal edge of left valve thick, the ventral overlap also rather wide; posterior extremity bluntly acuminate, the dorsal half of the outline nearly straight in the left valve and barely concave in the right valve, the lower half arching broadly into the ventral margin; anterior extremity less acuminate than the posterior, the outline being rounded in the lower half, nearly straight in the upper half, and abruptly bent about the mid-height. Valves unequal, the left much the larger, and the middle part of its dorsal outline distinctly convex, while the corresponding part of the right valve is sufficiently straightened to form obtuse angles at the ends of the hinge. Surface of both valves evenly convex and smooth.

This species agrees better with *B. cestriensis* Ulrich than with any other known to the writers. The principal difference lies in the shape of the posterior end, this being longer and the upper half of its outline straighter. Other differences are found in the greater dorsal overlap, in the more curved ventral edge, and in the more uniformly curved (lanceolate) outline in edge views. In young examples of the two species these differences, however, are less readily apparent than in fully developed specimens. *B. plebeia* McCoy, which of the European species is perhaps the nearest, is distinguished at once by its proportionally greater length.

The writers have a large number of specimens of *Bairdia*, apparently representing six or seven species, procured mainly from Upper Carboniferous rocks in the Mississippi Valley and Texas. Although these have not yet been subjected to critical study, it is believed that *B. beedei* occurs in some of the lots. However, pending careful comparisons, it would be unwise to attempt giving either the stratigraphic or the geographic distribution of the species.

*Formation and locality.*—Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

*Holotype.*—Cat. No. 35634, U.S.N.M.

**BAIRDIA BEEDEI ABRUPTA, new variety.**

Plate XI, figs. 21, 22.

Length 1.28 mm, height 0.72 mm, thickness 0.47 mm.

Longer than the typical form of the species, but with a more abruptly tapering and therefore blunter and relatively shorter posterior end. Although the dorsal and ventral parts are nearly the same in the two varieties, the outlines of their respective smaller (right) valves seem to differ, the height at the post-cardinal angle being proportionally greater in the variety *abrupta* than in the typical variety. The last difference possibly may be, in part at least, accounted for by individual differences in the amount of dorsal overlap.

Though still too short and with blunter extremities, this variety nevertheless is much nearer *B. plebeia* McCoy than is the typical form of the species. At the same time it is farther from *B. cestriensis* Ulrich.

*Formation and locality.*—Associated with typical *B. beedei* and many other ostracods in the Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

*Holotype.*—Cat. No. 35635, U.S.N.M.

**Family CYPRIDINIDÆ.****Genus CYPRIDINA Milne Edwards.****CYPRIDINA SUBOVATA, new species.**

Plate XI, fig. 23-26.

Length of an average example 3.8 mm., height 2.9 mm., thickness 2.1 mm.

Carapace compressed subglobular, broadly oval in outline, generally wider behind than anteriorly, and deeply notched in front, with a sharp beak above and a well-marked angulation below. Valves slightly unequal, the outline of the left being somewhat produced in the post-cardinal portion and therefore less regularly curved than in the right valve. In end and edge views this portion of the left valve also projects beyond the plane of the remaining portions of the edge and probably overlaps the corresponding part of the edge of the right valve. Surface of valves smooth, moderately convex, the convexity not quite symmetrical, being greater in the dorsal part than in the central and ventral portions. Partially exfoliated shells expose the muscle spot. This is ovate, radially striated, and smaller and farther removed from the center of the valves than usual. Dividing the valve into four equal parts, the whole of the scar line lies within the antero-ventral fourth.

The slight overlap of the post-dorsal edge of the left valve possibly allies this species to *Entomocochus*, in which the same valve overlaps

the right in a similar manner, only the overlap in this case occurs in the antero-dorsal region. The anterior notch, however, is much deeper and the carapace less globose in *C. subovata* than in the two species of *Entomoconchus* so far described. In its general form *C. subovata* agrees rather closely with *C. phillipsiana* Jones, but the Kansas species may be distinguished at once by its much deeper anterior notch. There are slight differences also in the size and location of the muscle spot, and in the convexity of the valves, the curves in Jones's species being more symmetrical and the carapace on the whole a little thicker and with blunter edges. *C. primæva* (McCoy), another British species, corresponds rather better in the matter of the notch and also in convexity, but differs in outline, being more produced in the post-ventral region; also in having the notch lower, which causes the beak to project considerably farther beyond the lower extremity of the notch than is the case in *C. subovata*.

*Formation and locality*.—Not uncommon in the Lawrence shale at Lawrence, Kansas.

*Cotypes*.—Cat. No. 35626, U.S.N.M.

#### DESCRIPTION OF PLATE XI.

Unless otherwise stated, all the figures on this plate are magnified twenty times.

FIGS. 1-4. *Paraparchites humerosus*, new genus and species.

FIG. 1. Right valve showing general form of a rather large but otherwise average carapace.

2. Anterior view showing overlap of right valve dorsally, and slight ventral overlap of left valve.

3. Ventral view of same.

4. Interior of a right valve exhibiting dorsal prominence and linear socket for reception of corresponding portion of left valve.

Elendale formation, Manhattan, Kansas.

FIG. 5. *Beyrichia?* *radiata* Jones and Kirkby.

FIG. 5. Right valve of an old example apparently agreeing in all essential respects with the English types of the species.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIG. 6. *Beyrichia?* *emaciata*, new species.

FIG. 6. Right valve showing the sharply defined lobes and ridges and generally emaciated appearance characterizing this species.

Wreford limestone, 6 miles west of Reece, Kansas.

FIGS. 7, 8. *Beyrichiella bolliiformis*, new species.

FIG. 7. Left side of an entire carapace of the typical form of the species.

8. Dorsal view of same anterior end to left, showing the channeled back.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIGS. 9-11. *Beyrichiella bolliiformis tumida*, new variety.

FIG. 9. Left valve incomplete at the antero-dorsal angle. In this specimen the surface markings are very much as in the typical form of the species, but the whole anterior end is much more inflated.

10. Another left valve having the anterior swelling characterizing the variety but differing from other specimens in the obsolescence of the anterior one of the two median tubercles.
11. Ventral view of original of fig. 10, showing the inflation of the anterior end.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIG. 12. *Cythere ? haworthi*, new species.

- FIG. 12. View of left valve showing the ventral wing-like process, the tubercles and surface markings characterizing this minute species.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIGS. 13-15. *Kirkbya pinguis*, new species.

- FIG. 13. Left side of an example retaining both valves.

14. Posterior view of same specimen.

15. Ventral view of same.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIGS. 16, 17. *Kirkbya centronota*, new species.

- FIG. 16. Right valve of a fully developed and well-marked example showing the concentric arrangement of the ridges and reticulate ornament, and the strongly developed dorsal ridge.

17. Anterior view of same showing the thick dorsal and ventral edges.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIG. 18. *Beyrichiella gregaria*, new species.

- FIG. 18. Left valve of an average old example of this rather variable species. In young valves the obscurely defined ventral flange is much narrower or is wanting, and in such cases the denticulated contact edge beneath may be visible in a side view.

Coal Measures, Kansas City, Missouri.

FIGS. 19, 20. *Bairdia beedei*, new species.

- FIGS. 19, 20. Right side and ventral views of a complete example. End view about as in figure 22.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIGS. 21, 22. *Bairdia beedei abrupta*, new variety.

- FIGS. 21, 22. Views of right side and posterior end showing the more abruptly tapering posterior portion that distinguishes the variety. Edge view about as in figure 20.

Cottonwood shales, 2 miles east of Cottonwood Falls, Kansas.

FIGS. 23-26. *Cypridina suborata*, new species.

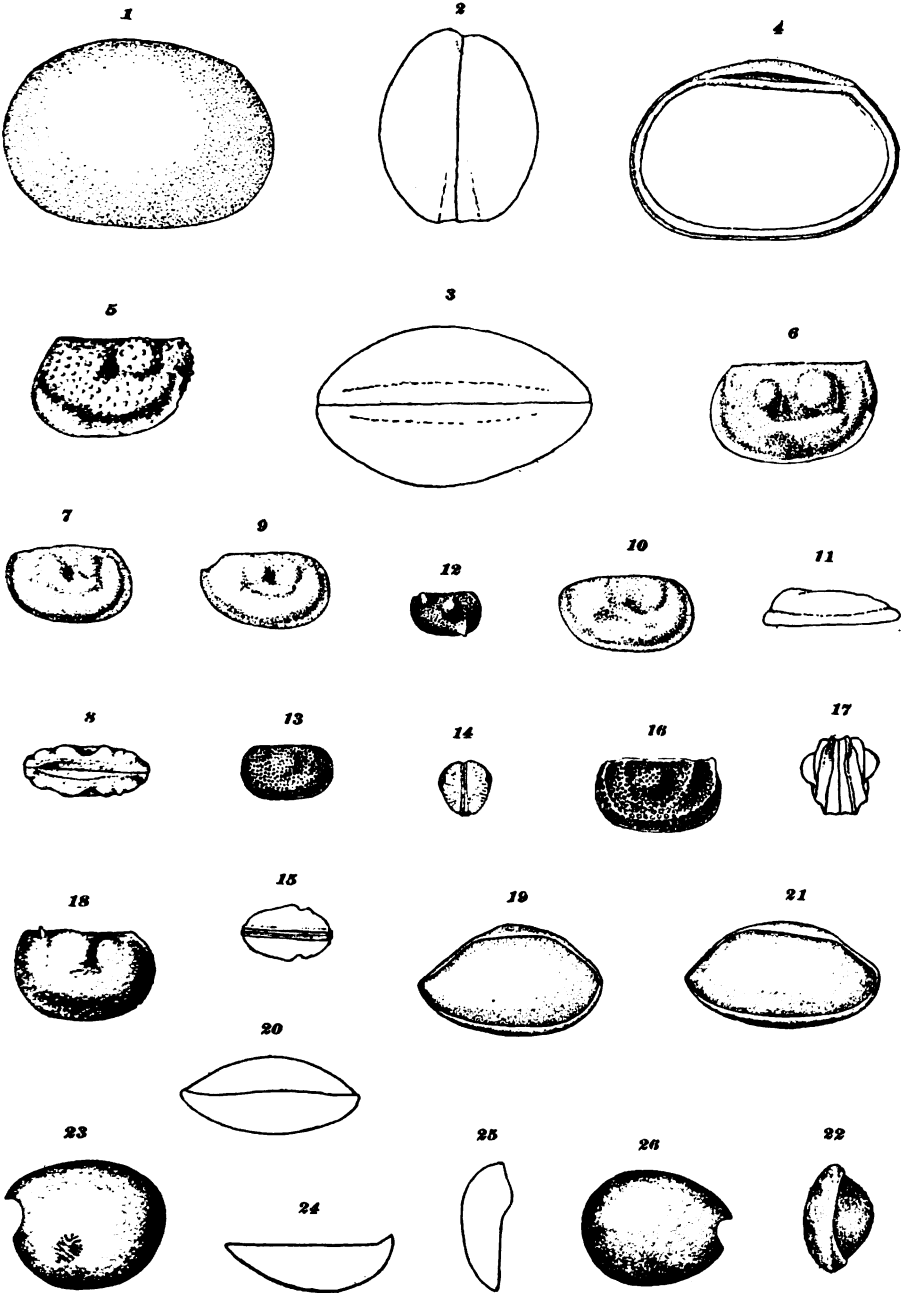
- FIG. 23. Left valve, with the test somewhat exfoliated, so as to show the muscular scar,  $\times 6$ .

24. Dorsal outline of same, showing postero-cardinal projection.

25. Posterior view in outline of same, likewise showing the post-cardinal projection of margin supposed to indicate a limited overlap of valves.

26. Right valve drawn from a gutta-percha squeeze,  $\times 6$ , showing slight difference in outline of post-cardinal portion when compared with left valve.

Lawrence shales, Lawrence, Kansas.



COAL MEASURES OSTRACODA.

FOR EXPLANATION OF PLATE SEE PAGES 163, 164.



## A NEW RUMINANT FROM THE PLEISTOCENE OF NEW MEXICO.

By JAMES WILLIAMS GIDLEY,  
*Of the Department of Geology.*

In excavating for the new irrigation dam at Black Rocks,  $4\frac{1}{2}$  miles east of Zuni, New Mexico, a number of fossil bones have recently been unearthed, which were preserved by Mr. John B. Harper, engineer in charge of the work. These bones were secured and presented to the U. S. National Museum by the Department of the Interior, through Mr. F. E. Leupp, Commissioner of Indian Affairs.

The little collection from Zuni contains teeth and bone fragments of *Elephas columbi* and other characteristic Pleistocene species, together with the top and back portions of a skull representing an undescribed genus of the Bovidae family, apparently closely related to *Ovibos*.

This specimen, though incomplete and battered, is of especial interest, coming from this locality. Its incompleteness and poor condition make it a rather unsatisfactory type, yet there are sufficient distinctive characters preserved to warrant its description.

### LIOPS, new genus.

*Generic characters.*—Horn cores set wide apart and well back, as in *Ovibos*, but much less drooping; continuous with the frontals laterally, with no burrs or rugosities at base; smooth throughout. Parietals forming a large part of the occiput, which is high and narrow above. No true lambdoidal crest. Foramen magnum about one and one-half times greater in diameter than in *Ovibos*. Occipital condyles set widely apart, with their borders continuous with the surrounding bones. Tympanic bone roughly triangular in shape, very smooth and flat, with no bulla, and tightly inclosed by the surrounding elements. Post-glenoid process reduced to a low rounded knob.

**LIOPS ZUNIENSIS, new species.**

Type, top and back portion of skull, Cat. No. 5100, U.S.N.M. collection.

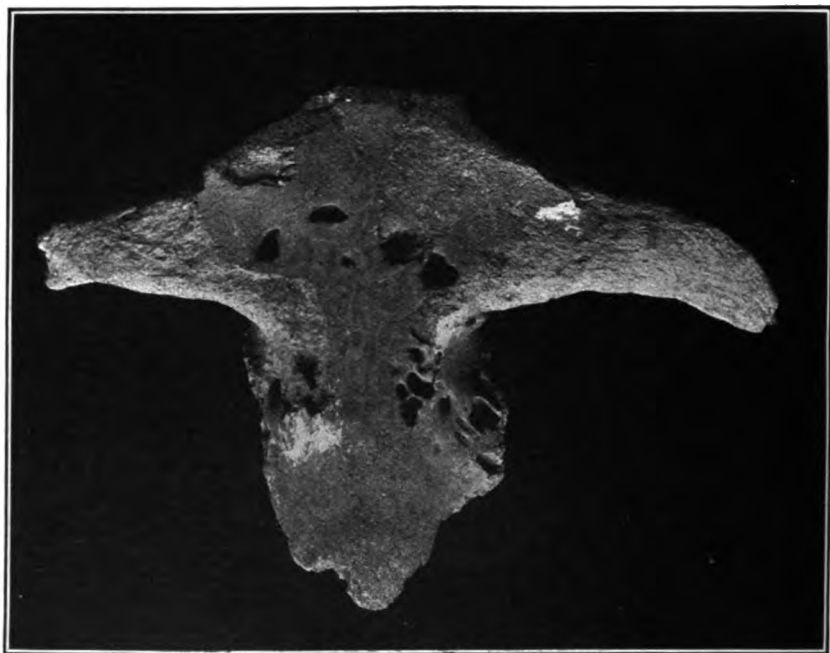


FIG. 1.—*LIOPS ZUNIENSIS*, TOP VIEW OF SKULL (ABOUT  $\frac{1}{2}$  NAT. SIZE).



FIG. 2.—*LIOPS ZUNIENSIS*, POSTERIOR VIEW OF SKULL (ABOUT  $\frac{1}{2}$  NAT. SIZE).

A striking feature of the portion of the skull preserved is its extreme smoothness. Its angles are free from rugosities, and there

are no sharp or roughened processes even in the tympanic and mastoid region. The horn cores are relatively longer, less robust, and less drooping than in *Ovibos* or *Simbos*, the latter standing directly intermediate between *Liops* and *Ovibos* in this respect. Another striking



FIG. 3.—*LIOPS ZUNIENSIS*, PALATAL VIEW OF SKULL (ABOUT  $\frac{1}{2}$  NAT. SIZE).

feature is the position of the relatively large foramen magnum, which is confined entirely to the back or occipital face of the skull.

*Liops* is apparently much more closely allied to *Ovibos* than either of the California Pleistocene genera, *Euceratherium* and *Preptoceros*, and seems, without question, to belong to the subfamily *Ovibovinae*.



## DESCRIPTIONS OF NEW HYMENOPTERA FROM JAPAN.

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By WILLIAM H. ASHMEAD,  
*Assistant Curator, Division of Insects.*

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In the following pages I continue the descriptions of the new genera and species of Japanese Hymenoptera in the National Museum, presented by Dr. K. Mitsukuri, of the Imperial University of Tokio; Mr. Y. Nawa, of Gifu; Dr. S. Matsumura, of Sapporo; Mr. Albert Koebele, of Honolulu, and others.

A few species are also included from China, Formosa, Trong, Lower Siam, etc. Six genera and seventy-three species are described as new to science.

Parts I and II of this series of papers were published in the Journal of the New York Entomological Society for 1904, and treated of the superfamilies Sphecoidea, Vespoidea, Proctotrypoidea, Cynipoidea, and Chalcidoidea. The present paper treats of the superfamily Ichneumonoidea.

### Superfamily VIII. ICHNEUMONOIDEA.

#### Family LXXV. ICHNEUMONIDÆ.

##### Subfamily I. ICHNEUMONINÆ.

##### MATSUMURAIUS, new genus.

This new genus belongs to the tribe Joppini, and will fall in my table of genera, Classification of the Ichneumon Flies, 1900, page 15, next to *Eccoptosarge* Kriechbaumer, but may be easily separated by the following characters:

Scutellum saddle-shaped, emarginate above ..... *Eccoptosarge* Kriechbaumer.  
Scutellum convexly rounded, not emarginate ..... *Matsumuraius*, new genus.

In the shape of the head, the venation, more or less, the scutellum, and the abdomen, this genus closely resembles *Automalus* Wesmael, but the metathorax is abruptly truncate posteriorly, the upper hind margin bounded by a carina, the angles toothed, the lateral and pleural carinæ distinct, while the spiracles are large and linear; the areolet of the front wings is large, pentagonal, the discoidal nervure and the second recurrent nervure being broken by a stump of a vein.

## MATSUMURAIUS GRANDIS, new species.

Plate XII, fig. 1.

*Male*.—Length 30 mm. Black, closely punctate; the clypeus and the entire face to the insertion of the antennæ, the inner orbits close to the apex of the eyes, the scape beneath, the upper hind margins of the pronotum interrupted medially, the tegulæ, a small spot beneath, the scutellum, and the legs, except as hereafter noted, are yellow; the hind coxæ beneath and at apex, all trochanters, except a yellow spot on the front pair, the extreme base of middle and hind femora, the apices of same and the apex of tibiæ are black. Abdomen black, except a small spot at apex of the petiole, dorsal segments 2 and 3, and the ventral segments 2 to 4 which are red. Wings hyaline, the apical margins smoky, the stigma and veins, except the subcostal and basal veins which are black or dark fuscous, being yellowish.

*Type*.—Cat. No. 7219, U.S.N.M.

*Locality*.—Sapporo. Described from a single specimen received from Doctor Matsumura and in honor of whom the genus is named.

Genus EXEPHANES Wesmæel.

## EXEPHANES KOEBELEI, new species.

*Female*.—Length about 10 mm. Black, closely punctate; the antennal joints 9 to 13 *beneath*, the tegulæ, the apex of the sixth abdominal segment, the seventh and eighth abdominal segments entirely, and the trochanters are white; the extreme apices of flagellar joints 1 to 5 are yellowish; the scutellum is pale yellowish; the apices of the femora, the front tibiæ and tarsi *beneath* are yellowish or testaceous, the front tarsi *above* and the middle tibiæ and tarsi are more brownish, the hind legs are black or brown-black, while the hind tibiæ are yellowish at the extreme base. Wings subfuscous, the stigma yellow, the veins brown. The metathorax is completely areolated, the areola being hexagonal.

*Type*.—Cat. No. 7220, U.S.N.M.

*Locality*.—Japan. One specimen taken by Mr. A. Koebele, the exact locality not stated.

Genus STENICHNEUMON Thomson.

## STENICHNEUMON SAPPOROENSIS, new species.

*Male*.—Length 16 mm. Black and punctate, with the face below the antennæ, the inner orbits to summit of eyes, the mandibles, except the teeth, the scape and pedicel, except above, the upper margin of prothorax, interrupted anteriorly, the tegulæ, a line beneath, the scutellum and postscutellum, a curved line on front coxæ, the legs, except the hind coxæ, femora and apical fourth of the hind tibiæ

which are black, a stripe on hind coxæ beneath and a small spot at sides near base, the second abdominal segment, except basal half, are all yellow. Wings subhyaline, faintly tinged, the stigma and costal vein yellow, the internal veins brown. The metathorax is areolated, but the basal and lateral areas are confluent, the areola subquadrate, the hind margin obtusely angulated.

*Type*.—Cat. No. 7221, U.S.N.M.

*Locality*.—Sapporo. One male, taken by Doctor Matsumura.

Genus MELANICHNEUMON Thomson.

MELANICHNEUMON JAPONICUS, new species.

*Female*.—Length, 14 mm. Black closely punctate, except the three or four terminal segments of the abdomen, which are nearly smooth; antennal joints 11 to 15, or at least beneath, a small line back of the eyes, the scutellum, and a large, oblong spot on all tibiae behind snow-white; there is also a small yellowish spot on the apical margin of the last dorsal abdominal segment. Wings subfuliginous, the veins black, the stigma being brownish within; tegulae shining black. The metathorax is completely areolated, the areola large, hexagonal. The gastrocoeli are not deep, situated at the basal lateral angles, and with irregularly longitudinally raised lines, but the space between them is broad and closely punctate, as is the rest of the abdomen.

*Type*.—Cat. No. 7222, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura).

Genus RHEXIDERMUS Förster.

RHEXIDERMUS JAPONICUS, new species.

Plate XII, fig. 2.

*Female*.—Length, 7.5 mm. Black, finely punctate, subopaque; the scutellum yellowish; flagellum reddish-brown, joints 10 to 14 above white; mandibles conically pointed, edentate, whitish, the tips blackish; legs ferruginous, the anterior and middle pairs, especially basally pale yellowish; abdomen much longer than the head and thorax united, above black, the petiole and the apical segments smooth and shining, or nearly, the segments 2, 3, and 4 distinctly closely punctate, ventral segments 2, 3, and 4, and the extreme lateral margins of the dorsal segments 2 to 4, testaceous; ovipositor subexserted, as long as the second joint of hind tarsi. Wings hyaline, the costal margin brown, the stigma and internal veins testaceous.

*Type*.—Cat. No. 7223, U.S.N.M.

*Locality*.—Japan (A. Koebele).

## Tribe VI. PHAEOGENINI.

Genus PHAEOGENES Wesmael.

PHAEOGENES JAPONICUS, new species.

*Female*.—Length, 5 mm. Black, with the first 7 joints of the antennæ, the legs, except tips of hind tibiæ, the first and second segments of the abdomen and the fourth very narrowly at base, red; the antennal joints 8 to 12 are more or less white, the joints beyond dark fuscus or black; the extreme apices of the abdominal segments 4 to 7, if viewed from behind, are more or less testaceous, although not noticeable from above. Wings hyaline, the tegulæ and veins basally whitish, the stigma and internal veins brownish. The head above is faintly, sparsely punctate, but in front below the insertion of the antennæ, except the clypeus, it is more closely and distinctly punctured; the clypeus is highly polished with a few scattered punctures; the thorax is distinctly, finely, but not very closely, punctured, the metathorax being finely rugulose punctured and distinctly areolated; the abdomen has the petiole highly polished, impunctate, the second and third segments subopaque, while those beyond are shining.

*Type*.—Cat. No. 7225, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura).

Subfamily II. CRYPTINÆ.

## Tribe II. PHYGADEUONINI.

Genus BATHYMETIS Förster.

BATHYMETIS SAPPOROENSIS, new species.

*Female*.—Length, 3.5 mm.; ovipositor shorter than the petiole. Head, thorax and petiole of the abdomen black, the rest of the abdomen, except the sheathes of the ovipositor, which are black, dark red; antennæ about 26-jointed, thickened toward apex, yellowish from the base to the sixth joint, from whence they are dusky or brownish; mandibles red; palpi and tegulæ yellowish white; legs, including coxæ, ferruginous. The head and thorax, except the metathorax which is rugulose and areolated, are smooth and shining, impunctate. Wings hyaline, the stigma and costæ reddish-brown, the internal veins paler.

*Type*.—Cat. No. 7226, U.S.N.M.

*Locality*.—Sapporo. (Dr. S. Matsumura.) One specimen, No. 38.

Genus SCINASCOPUS Förster.

SCINASCOPUS JAPONICUS, new species.

*Male*.—Length, 4 mm. Black and shining; the palpi, tegulæ and legs, except the coxæ which are blackish, the hind femora toward base above and the tips of the hind tibiæ which are reddish or brownish, are

yellowish white; the antennæ are light brownish yellow beneath; the abdomen is longer than the head and thorax united, the petiole subrugulose, subopaque and with carinæ, the other segments being smooth. Wings hyaline, the stigma and veins reddish-brown.

*Type*.—Cat. No. 7227, U.S.N.M.

*Locality*.—Sapporo. (Dr. S. Matsumura.) One specimen, No. 29.

**SCINASCOPUS ALBOMACULATUS, new species.**

*Male*.—Length, 8 mm. Black; the palpi, the mandibles, except teeth, the clypeus, a spot above it, a spot on scape beneath at apex, the tegulæ and epitegulæ, the front and middle trochanters, except sometimes a stripe above, and the apical margin of the seventh dorsal segment of the abdomen, are ivory white; the tips of the front femora and their tibiæ, and the middle tibiæ are light brownish or yellowish. Wings hyaline, the stigma and veins dark brown.

*Type*.—Cat. No. 2728, U.S.N.M.

*Locality*.—Nikko (A. Koebele).

**Tribe III. HEMITELINI.**

**Genus ADIOSTOLA Förster.**

**ADIOSTOLA POLITA, new species.**

*Female*.—Length, 2.5 mm.; ovipositor less than half the length of the abdomen; black and shining; palpi and tegulæ white; antennæ brown, the scape and pedicel yellowish; legs, except the hind coxæ, testaceous, the trochanters tinged with yellowish white. Wings hyaline, the stigma and veins, except along the costa of the front wings, pale yellowish, the costal edge being brown.

*Type*.—Cat. No. 7229, U.S.N.M.

*Locality*.—Japan (A. Koebele). Two specimens.

**Genus PARAPHYLAX Förster.**

**PARAPHYLAX ALBISCAPUS, new species.**

*Male*.—Length 3 mm. Black and shining; the palpi, mandibles, except teeth, scape of antennæ, tegulæ, and middle trochanters, yellowish white; flagellum brown-black, long and tapering off at apex; legs testaceous, the coxæ and tibiæ more or less yellowish white in part or beneath, the hind tibiæ at apex and their tarsi dusky, the hind trochanters, except the second joint above, and the hind tibial spurs ivory white. Wings hyaline, the stigma brown, the costal margin blackish, the internal veins pale brownish or yellowish.

*Type*.—Cat. No. 7230, U.S.N.M.

*Locality*.—Japan (A. Koebele). One specimen.

## Genus HEMITELES Gravenhorst.

## HEMITELES SAPPOROENSIS, new species.

*Female*.—Length 4.5 mm.; ovipositor scarcely one-third the length of the abdomen. Head reddish-brown, with a black spot on the vertex inclosing the ocelli, and finely shagreened; thorax, except the prosternum, which is reddish brown, black, finely shagreened and opaque, the parapsidal furrows absent, the metathorax completely areolated; abdomen reddish-brown, with the petiole black, and the disks of the dorsal segments more or less dusky or blackish; antennæ, except toward tips, and legs ferruginous. Wings hyaline with two transverse brown bands, one across from the basal nervure and inclosing it, and the other, a broader one, across from near the base of the stigma and including the marginal cell.

*Type*.—Cat. No. 7231, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumura). One specimen, No. 27.

## PROTEROCRYPTUS, new genus.

This new genus belongs to the tribe *Hemitelini*, and in my table of genera, Classification of Ichneumon Flies, 1900, page 32, falls in with *Diaglypta* Förster, with which, however, it has no close affinity. The table may be changed to read as follows:

15. Metathoracic ridge *not* interrupted at the middle..... 16  
Metathoracic ridge interrupted at the middle, the areola and petiolar area confluent.

First abdominal segment short, broad, and strong ..... *Diaglypta* Förster

First abdominal segment long and slender, subclavate; thorax rather short oval, the prothorax not visible from above, the parapsidal furrows absent, the metathorax rather short, rounded off posteriorly and areolated, the areola and petiolar area confluent, the spiracles small, circular.

*Proterocryptus*, new genus

## PROTEROCRYPTUS NAWAII, new species.

Plate XII, fig. 3.

*Female*.—Length about 6 mm.; ovipositor hardly one-third the length of the abdomen. Black, marked with white or yellow as follows: The face, clypeus, the narrow malar space, mandibles, scape and pedicel beneath, hind and front orbits, connected with a band across the forehead, two stripes down the mesonotum, the upper margin of the prothorax at sides broadly to the tegulæ, the tegulæ, a large spot on mesopleura anteriorly, the scutellum, the postscutellum, the mesonotum, except a narrow band at base and at apex surrounding the insertion of the petiole, all coxæ and trochanters, except a black spot on hind coxæ at base behind and a spot on their trochanters *above*, and the apical margins of the abdominal segments (the fifth and sixth

interrupted medially) are white or yellowish-white; legs pale or yellowish-white; the base of hind coxæ behind, spot on their trochanters above and the apices of hind femora and tibiæ, black. Wings hyaline, the stigma and veins reddish brown, the costal and poststigmatal veins black, the venation as in figure. The thorax is closely punctate, otherwise the insect, except some minute sparse punctures on the face, is smooth and shining.

*Type*.—Cat. No. 7233, U.S.N.M.

*Locality*.—Atami (A. Koebele).

### Tribe VI. CRYPTINI.

Genus CRYPTUS Fabricius.

CRYPTUS ALBERTI, new species.

*Female*.—Length 10 mm.; ovipositor a little longer than half the length of the abdomen. Black, finely, closely punctate, subopaque and pubescent, the metathorax rugulose, with two transverse carinæ; antennæ black, with joint 7 at apex *beneath* and joints 8 to 11 *beneath*, white; legs black, with the apex of front femora and the front and middle tibiæ reddish, their tarsi subfuscous, the hind legs wholly black, except tarsal joints 3 and 4, which are white; the abdomen, except the petiole, is subopaque, the second and following segments very delicately shagreened, a little shiny at their apices, the sixth dorsal segment narrowly white at apex, the petiole smooth and shining. Wings subhyaline, the stigma and veins dark brown, the discoidal nervure broken by a stump of a vein, the areolet rather large, pentagonal, the sides almost parallel.

*Type*.—Cat. No. 7232, U.S.N.M.

*Locality*.—Japan (A. Koebele).

### Tribe VII. MESOSTENINI.

Genus MESOSTENUS Gravenhorst.

MESOSTENUS OCTOCINCTUS, new species.

*Female*.—Length about 8 mm.; ovipositor half the length of the abdomen. Black and closely punctured; the mandibles, except teeth, the clypeus, face and front orbits to the summit of the eyes, the cheeks and the hind orbits not quite to the summit of the eyes, the palpi, the antennal joints *beneath* from the apex of the sixth to the sixteenth joint, a band on the prothorax above, interrupted at the middle, a round spot on the disk of the mesonotum, the scutellum and its lateral ridges anteriorly, a streak on the post-scutellum, the tegulæ, a line beneath, two spots on the mesopleura, a spot on the mesosternum, a large spot on the metapleura, the margins of the metathoracic truncature broadly, all coxæ and trochanters, except a black spot on

the hind coxæ above and a spot on the first joint of the hind trochanters, the tibial spurs and the hind tarsi, except the last joint, are white; rest of legs, except knees of hind legs, tips of hind tibiæ and last joint of tarsi which are black, red; the eight segments of the abdomen are banded with yellowish white at apex, those of the fifth and sixth interrupted, those on the following very narrow. Wings hyaline, the veins dark brown, the lanceolate stigma brownish medially.

*Male*.—Length 7 mm. Agrees practically in every respect with the female, but differs in having joints 9 to 16 of antennæ white, except a streak above, the abdomen with only 7 segments, compressed at apex, all being banded at apex with white and none interrupted medially.

*Type*.—Cat. No. 7234, U.S.N.M.

*Locality*.—China (A. Koebele).

Subfamily III. PIMPLINÆ.

Tribe III. LISSONOTINI.

Genus PIMPLOPTERUS Ashmead.

PIMPLOPTERUS JAPONICUS, new species.

*Male*.—Length 7 mm. Black; the mandibles, the clypeus, a minute dot on orbits *within* near the base of the eyes, the palpi, an irregular band on each side of the anterior margin of the mesonotum, the tegulæ, front coxæ and trochanters and the tibial spurs yellowish or yellowish white; the rest of the legs, except the hind coxæ, tips of hind tibiæ, and the hind tarsi which are black, red. Wings hyaline, the stigma and veins brown. The head is shining, almost impunctate above, but finely punctate in front; the mesonotum although shining is distinctly punctate; the metathorax finely rugulosely punctate and subopaque; the long abdomen is black, subopaque, but the extreme apical margins of dorsal segments 2 to 6 exhibit a yellowish tinge when viewed from behind. Wings hyaline, the stigma and veins brown.

*Type*.—Cat. No. 7235, U.S.N.M.

*Locality*.—Hakone (A. Koebele).

Tribe IV. PIMPLINI.

Genus MEGARHYSSA Ashmead.

MEGARHYSSA JAPONICA, new species.

*Female*.—Length 32 mm.; ovipositor 40 mm. Black; face below the antennæ to the clypeus, except a median black line, the hind orbits broadly to the cheeks, the palpi, the upper lateral margins of the pronotum, an oblong spot above the front coxæ, a large spot below the tegulæ and a smaller spot below that on the anterior margin of the

mesopleura, two longitudinal lines on the mesonotum, the scutellum and postscutellum, a small spot on the lateral ridges that extend from the scutellum, the apex of the metathorax rather broadly, a large spot at the apex of the metapleura, a band at apex of dorsal abdominal segments 1 and 2, and oblong spots on segments 3 to 7, yellow; the legs are tricolored, yellow, black, and ferruginous; the front legs, except the coxæ behind which are black, and the femora within which are reddish are yellow; the middle coxæ, except two united spots at the sides, the base of first joint of the trochanters and the femora beneath and behind, except at apex, are black, otherwise the middle legs are yellow; the hind legs are black, but the the coxæ have a spot at base above, the base of the trochanters and the femora at apex yellow. Wings subfuscous, with a large black cloud across from the apical half of the stigma to beyond the middle of the front wing.

*Type*.—Cat. No. 7238, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura). This beautiful species shows some affinity with *M. superba*.

#### HEMIEPHIALTES, new genus.

This new genus, on account of having the claws simple, will fall in my generic table of the Pimplini, Classification of the Ichneumon Flies, 1900, page 54, between *Calliephialtes* Ashmead and *Perithous* Holmgren. My generic table may be modified as follows:

- |  |                                   |
|--|-----------------------------------|
| 8. Front wings <i>with</i> an areolet.....   | 84                                |
| Front wings without an areolet.  |                                   |
| Metathorax finely, sparsely punctate, with the lateral areas present, the superior margin of the truncature bounded by a delicate carina, the spiracles small, oval; transverse median nervure in hind wings broken far <i>below</i> the middle..... | <i>Hemiephialtes</i> , new genus. |
| 84. Metathorax smooth, shining, without punctures; areolet in front wings rhomboidal, not petiolate; transverse median nervure in hind wings broken <i>above</i> the middle.....   | <i>Perithous</i> Holmgren.        |

#### HEMIEPHIALTES GLYPTUS, new species.

Plate XIII, fig. 1.

*Female*.—Length about 12 mm.; ovipositor much longer than the whole body. Black, finely punctate; legs pale ferruginous, the front coxæ and trochanters, the second joint of the hind trochanters, except a spot above, and an annulus at base of hind tibiæ, yellowish white, while the first joint of hind trochanters, the hind femora, tibiæ, and tarsi are black. Wings subfuscous, the tegulæ and costal veins yellowish white, the internal veins and the stigma dark fuscous or black. The abdomen is elongate, nearly twice as long as the head and thorax united, closely punctate, opaque or subopaque, except a small shining

impunctate space at apex of the first, second, and third segments; the second, third, and fourth segments have oblique furrows from the basal middle much as in the genus *Glypta* Gravenhorst.

*Type*.—Cat. No. 7237, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura).

Genus *PIMPLA* Fabricius.

*PIMPLA PLUTO*, new species.

*Female*.—Length 15 mm.; ovipositor 4 mm. Entirely black, except the two apical joints of the palpi which are brownish, a stripe on the front femora in front, and the front tibiæ, except a stripe above, which are reddish, the stripe above on the front tibiæ and the front tarsi are brownish. The whole insect is closely punctate, opaque, except the face, which is more sparsely punctate and shining, the clypeus being distinctly separated from the face, with only a few sparse punctures at its base. Wings subfuliginous, the stigma, except a pale spot at base, and the veins black. The metathorax is entirely without carinæ.

*Type*.—Cat. No. 7240, U.S.N.M.

*Locality*.—Japan (A. Koebele).

Genus *APECHTHIS* Förster.

*APECHTHIS ORBITALIS*, new species.

Plate XIII, fig. 2.

*Female*.—Length 20 mm.; ovipositor not quite 5 mm. Black, the head and upper part of thorax opaque but not punctate, the sides of the thorax and the scutellum sparsely punctate, shining; the inner orbits within the incision of the eyes, the apex of the scutellum, and the postscutellum are yellowish; the base of the metanotum inclosed by the two diverging carinæ is smooth and shining, impunctate but the surface on either side of the carinæ is closely punctate, as well as abdominal segments 1 to 5, the following segments being almost smooth; the front legs from the apex of the coxæ, the middle legs from the second joint of the trochanters, and the basal two-thirds of the hind tibiæ, except a narrow black annulus at base, are flavo-testaceous, the hind femora being rufous, the rest of the legs black. Wings, except a faint tinge, hyaline, the stigma and veins, except a pale spot between the parastigma and stigma, being black.

*Type*.—Cat. No. 7242, U.S.N.M.

*Locality*.—Japan (A. Koebele).

*APECHTHIS SAPPOROENSIS*, new species.

*Female*.—Length 15 mm.; ovipositor short, about one-fourth the length of the abdomen. Black, the head and thorax not punctate, the face slightly shagreened, with some transverse rugæ just beneath the

insertion of the antennæ, the mesonotum subopaque, the metathorax sparsely punctate on either side of the quadrate median inclosure, the basal median inclosure smooth and highly polished, open posteriorly; the abdomen is distinctly, closely punctate; the ocelli are yellowish white; the palpi blackish, with the two or three apical joints yellowish; the antennæ are black, but with the basal two or three joints of the flagellum *beneath* ferruginous; the apex of the scutellum, the post-scutellum, the front legs, except the coxæ, trochanters, the femora *above* and a spot on the tibiæ *behind*, the apex of the middle tibiæ, an annulus toward base and their tarsi, and an annulus toward base of the hind tibiæ, and tibial spurs, pale yellowish, the rest of legs black. Wings hyaline, the hind margins of the tegulæ, a very small spot in front and the costal vein pale yellowish white, the stigma and other veins black.

*Type*.—Cat. No. 7241, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura).

#### Genus EPIURUS Förster.

#### EPIURUS ANNULITARSIS, new species.

*Female*.—Length about 10 mm. Black and shining, the head and thorax, except some punctures on the sides of the metathorax, almost impunctate; palpi and tegulæ yellowish white; legs red, the hind tibiæ and tarsi yellowish white, the hind tibiæ with an annulus near base and their apices black; pulvilli and claws black. Wings hyaline, the parastigma, stigma, and poststigmatal vein yellowish, the internal veins brownish. The metanotum has two median carina above that converge toward base, and back of these are two large impressions bounded by a carina on each side and at apex, the space between this carina and the pleural carina being punctate, but the upper face of the metanotum is smooth and impunctate.

*Type*.—Cat. No. 7245, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumura). One specimen, No. 6.

#### EPIURUS HAKONENSIS, new species.

*Female*.—Length about 12 mm.; ovipositor as long as the abdomen, the sheaths very hairy. Black and shining, the head smooth, impunctate, the thorax faintly, feebly punctate, except the middle mesothoracic lobe anteriorly and the metathorax, which are distinctly punctate; the abdomen is distinctly, rather closely punctate, except at the apical margins of segments 2 to 6 and the two apical segments, which are impunctate; the palpi, pedicel, and first three joints of the flagellum beneath, the tegulæ, a line beneath, and the costal vein at basal half, yellowish white; the legs are ferruginous, the front coxæ, trochanters, and tarsi, the middle trochanters, apex of middle femora, an annulus at base of their tibiæ, all tibial spurs, an annulus at base of hind tibiæ,

a broader one on their middle, and an annulus at base of their tarsi, yellowish white; rest of hind tibiæ and tarsi black. Wings faintly tinged with fuscous, the stigma and internal veins black or dark fuscous.

The metathorax has an apical area indicated, the surface within punctate. The first abdominal segment is not longer than wide.

*Type*.—Cat. No. 7243, U.S.N.M.

*Locality*.—Mount Hakone (A. Koebele); also Sapporo (Doctor Matsumura).

**EPIURUS PERSIMILIS, new species.**

*Female*.—Length 11 mm.; ovipositor as long as the abdomen. Very similar to *E. hakonensis*, except as follows: The antennæ are wholly black, except the extreme apex of the scape, which is white; the front legs, except the femora, the middle legs, except the coxæ and femora, and the hind trochanters and hind tibiæ at basal two-thirds, except a narrow black annulus near the base, are yellowish white, rest of legs, except the apical third of hind tarsi, the annulus near the base, and the hind tarsi, which are black, being rufous; metanotum without an area at base, the median space smooth, impunctate; first abdominal segment a little longer than wide.

*Type*.—Cat. No. 7244, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura).

**NESOPIMPLA, new genus.**

In my generic table of the *Pimplini*, Classification of the Ichneumon Flies, 1900, page 53, this new genus will fall in with *Itoplectis* Förster and *Eremochila* Förster, the claws not being toothed at base and the metathoracic spiracles being round, but from both it is easily separated by the areolet of the front wings, which is irregularly pentagonal in shape, resembling that found among the *Phygadeuonini*; the transverse median nervure in the front wings is interstitial with the basal nervure, while in the hind wings it is broken by the subdiscoidal nervure far above the middle; the metathorax has two distinct longitudinal carinæ that diverge posteriorly and end just over the insertion of the hind coxæ; the abdomen is much as in *Pimpla* Fabricius, the apex of segments 2 to 6 tumid, 3 to 6 with transverse impressions a little beyond the lateral middle, the second segment with the transverse impression distinct only laterally at the apical angles, broadly interrupted at the middle.

**NESOPIMPLA NARANYÆ, new species.**

Plate XIII, fig. 3.

*Female*.—Length 9.5 mm.; ovipositor short, less than one-third the length of the abdomen. Head, thorax, and the abdominal segments 6 to 8, except narrowly at apex black, the abdominal segments 1 to 5,

and the antennæ, except the two basal joints, pale ferruginous; palpi and legs yellowish white; the hind coxæ behind and the hind femora pale ferruginous, the extreme apex of the hind femora, an annulus at base, and the apex of the hind tibiæ being black; the tarsal joints 1 to 5 are tipped with black. Wings hyaline, the stigma, except a spot at base, and the internal veins black.

*Type*.—Cat. No. 7247, U.S.N.M.

*Locality*.—Sapporo. Bred by Doctor Matsumura from *Naranya diffusa*.

Genus *THERONIA* Holmgren.

*THERONIA JAPONICA*, new species.

*Female*.—Length 11 mm.; ovipositor about one-third the length of the abdomen. Yellowish; the suture at base of clypeus, a median line on face, the frontal depressions back of the origin of the antennæ, the space surrounding the ocelli, the occiput and the eyes, black; the flagellum is brown; thorax at sides and beneath black, the upper margin of the pronotum, the margin of the prosternum, the tegulæ, the ridge beneath, a small line on mesopleura anteriorly and a spot posteriorly, a spot on metapleura, the apex of metathorax broadly, the postscutellum, scutellum, and two lines on the mesothorax, yellow, the middle lobe of the mesonotum is black while the lateral lobes are brownish; abdomen yellowish, the first segment black at basal half or more, the following dorsal segments more or less dusky at base; legs yellowish, but with a spot at base of middle coxæ, a spot on middle femora beneath, the hind coxæ anteriorly and the hind femora beneath, black. Wings hyaline, the costal vein and the stigma yellow, the internal veins brown.

*Type*.—Cat. No. 7239, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura).

### Tribe V. XORIDINI.

Genus *ODONTOMERUS* Gravenhorst.

*ODONTOMERUS NIKKOENSIS*, new species.

*Female*.—Length 8 mm.; ovipositor nearly as long as the body. Black, with segments 3 to 5 of the abdomen dark rufopiceous, the front tibiæ and tarsi testaceous; the middle tibiæ and tarsi darker; the hind legs, except the tibiæ beneath which have a piceous tinge, wholly black; antennæ brown; palpi white. Wings hyaline, the stigma and veins brown. The head and thorax, except the metathorax, are smooth and shining, almost impunctate; the mesonotum only sparsely punctate, more distinct on the prominent middle lobe anteriorly; the petiole and the second segment of the abdomen are finely shagreened, subopaque; the other segments smooth and shining.

*Type*.—Cat. No. 7248, U.S.N.M.

*Locality*.—Nikko (A. Koebele).

## Genus CALLICLISIS Förster.

## CALLICLISIS INCERTA, new species.

Plate XIV, fig. 1.

*Male*.—Length about 19 mm. Black and shining, although sparsely punctate; the face, except a central black line, scape of antennæ beneath, the pedicel, basal three or four joints of the flagellum, mandibles, palpi, tegulæ, epitegulæ, all legs from the coxæ, except the hind femora, a spot at apex of first dorsal abdominal segment, a band at apex of the second segment, the third and fourth wholly, except a brownish shade at base of the fourth, a band at apex of the following segments and the venter, testaceous or yellowish, the coxæ black, the hind femora, except at base and apex, blackish or brown-black. Wings hyaline; the stigma, except a median streak from its base, and the veins black. Antennæ, except as noted, black from the fifth or sixth joint. The abdomen is fully one and a half times as large as the head and thorax united and compressed from the third segment.

*Type*.—Cat. No. 7249, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumura).

## Subfamily IV. TRYPHONINÆ.

## Tribe I. MESOLEPTINI.

## Genus SYCHNOLETER Förster.

## SYCHNOLETER JAPONICUS, new species.

*Female*.—Length 8 mm. Black, closely, minutely punctate, opaque, with the second, third, and basal half of the fourth segment of the abdomen, red; the apical half or more of the front femora, their tibiæ and tarsi, the middle tibiæ, except at extreme apex, and the basal three-fourths of the hind tibiæ are testaceous; the tibial spurs, joints 3 and 4 of the hind tarsi, and an annulus on the antennæ (comprising joints 13 to 18), are white; the flagellum outwardly is more or less ferruginous. Wings hyaline, the stigma and veins brown.

*Type*.—Cat. No. 7250, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumura). One specimen, No. 23.

## Tribe IV. TRYPHONINI.

## Genus RHIMPHALEA Förster.

## RHIMPHALEA DUBIA, new species.

*Male*.—Length 4.5 mm. Black and shining, impunctate; antennæ yellowish beneath, the scape black above, the flagellum dark brown above; palpi and tegulæ white; legs, except coxæ, pulvilli and claws, and a spot at apex of hind tibiæ which are black, flavo-testaceous, the tibiæ and tarsi yellowish white, the tips of coxæ whitish, the hind femora reddish. Wings hyaline, the stigma and veins dark brown.

The second and third dorsal segments of the abdomen have a transverse depression or furrow at the middle.

*Type*.—Cat. No. 7251, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumura). One specimen, No. 24.

#### Genus ASTHENARA Förster.

#### ASTHENARA RUFOCINCTA, new species.

*Male*.—Length 8.6 mm. Black and shining, with the second and third segments of the abdomen red; the cheeks, front orbits, and a spot back of eyes, a spot on each side of the middle mesothoracic lobe anteriorly, a line on the lateral margin of the lateral lobes in front of the tegulæ, a line beneath the tegulæ, the front trochanters in part and the base of the front femora, the middle trochanters, the apex of middle and the sutures of the hind trochanters are white; the front and middle tibiæ and tarsi yellowish; rest of the legs black; the hind legs, except the tibial spurs and the sutures of the trochanters, wholly black. Wings hyaline, or only faintly tinged, the stigma and veins brown.

*Type*.—Cat. No. 7252, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumura). One specimen, No. 34.

#### Tribe V. BASSINI.

#### Genus BASSUS Gravenhorst.

#### BASSUS JAPONICUS, new species.

*Female*.—Length 4.5 mm. Black and shining, but punctate; the palpi, mandibles, clypeus, face, inner orbits, scape and pedicel beneath, front margins of the lateral lobes of the mesonotum, scutellum, a transverse line on the ridge at base of the metanotum, the tegulæ, a spot beneath, the epitegulæ, the origin of veins at base of the wings, the front and middle legs, apex of hind coxæ and trochanters and two-thirds of the hind tibiæ, except an annulus at base, are white or yellowish-white, the rest of the legs being black, except the front and middle femora and tibiæ, which are tinged with red; the extreme apical margins of dorsal abdominal segments 5, 6, and 7 are whitish; flagellum black brownish at base beneath. Wings hyaline, the costal veins and stigma blackish, the internal veins brown.

*Type*.—Cat. No. 7253, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumura). Two specimens, No. 40.

#### Genus SYRPHOCTONUS Förster.

#### SYRPHOCTONUS ATAMIENSIS, new species.

*Male*.—Length about 5 mm. Black; clypeus, a quadrate spot above, a triangular spot on inner orbits below the middle of the eyes, scape and pedicel of antennæ and front coxæ and trochanters yellowish-white.

*Locality*.—Atami (A. Koebele).

## Tribe VII. EXOCHINI.

Genus EXOCHUS Gravenhorst.

EXOCHUS HAKONENSIS, new species.

*Female*.—Length 6 mm. Black and shining; the face, palpi, tegulae, the basal two-thirds of the hind tibiae, except an annulus at base, the tibial spurs and tarsi, except at apex, are white; the rest of the legs red. Wings hyaline, the veins and the stigma, except within, brown.

*Type*.—Cat. No. 7255, U.S.N.M.

*Locality*.—Hakone (A. Koebele).

Subfamily V. OPHIONINÆ.

## Tribe V. CAMPOPLEGINI.

Genus CAMPOPLEX Gravenhorst.

CAMPOPLEX HAKONENSIS, new species.

*Female*.—Length 11 mm.; ovipositor as long as the abdomen. Black, closely punctate, pubescent, opaque, the petiole alone smooth and shining; the palpi, tegulae, and tibial spurs are white; scape of antennae beneath yellowish; the front legs, except coxae and first joint of trochanters, apex of middle femora and their tibiae and tarsi, and the hind tibiae behind from near base to apical third, are testaceous or reddish. Wings hyaline, the stigma and veins dark brown.

*Type*.—Cat. No. 7256, U.S.N.M.

*Locality*.—Hakone (A. Koebele).

CAMPOPLEX BICOLORIPES, new species.

*Male*.—Length 13 mm. Resembles the former species, but the color of the legs and abdomen is different. The apex of the second dorsal abdominal segment and the third, fourth, and fifth segments are red; the front and middle legs, except coxae, are yellowish-white, the femora tinged with reddish, the front coxae with a white spot at apex, the hind legs, except the tibial spurs and a narrow annulus at base of tarsi which are white, are entirely black.

*Type*.—Cat. No. 7257, U.S.N.M.

*Locality*.—Hakone (A. Koebele).

## Tribe VII. BANCHINI.

NAWAIA, new genus.

This new genus belongs to the tribe *Banchini*, and in my generic table, Classification of the Ichneumon Flies, 1900, page 96, falls in next to the American genus *Ceratosoma* Cresson, page 97, now *Cerato-gastra* Ashmead, Cresson's name being preoccupied. It agrees with this genus in the shape of the abdomen, but differs quite widely in

other characters: The areolet in the front wings is large and pentagonal; the median cell is a little shorter than the submedian; the transverse median nervure in the hind wing is broken at its basal angle, the subdiscoidal nervure being almost interstitial with the median vein; the clypeus has a slight median sinus; the scutellum ends in a small tooth; while the claws are simple.

The genus is named in honor of Mr. Y. Nawa, the well-known entomologist of Japan, proprietor of the entomological laboratory in Gifu, also the editor of that interesting Japanese magazine, *The Insect World*, and one who has done so much to stimulate entomological research throughout Japan.

**NAWAIA JAPONICA, new species.**

Plate XIV, fig. 3.

*Female*.—Length, 11 mm. Black; the orbits, the face below antennæ, except a median black line and a black line at base of clypeus, the mandibles, the palpi, the upper margin of pronotum, two lines on the mesonotum which curve outwardly at the anterior margin, the tegulæ, a spot beneath, the scutellum except the transverse furrow at base and a spot at apex inclosing the apical tooth, the postscutellum, the metathorax except a black transverse band at base, bands at apex of all the segments of the abdomen (the bands widening posteriorly so that the apical segments are almost wholly yellow), two lines on first segment, two spots at base of second, the apices of all femora and the front and middle femora beneath second joint of trochanters, most of middle tibiæ except a spot at base and a stripe behind, a large spot on hind coxæ behind, and an annulus on the hind tibiæ before the middle, all yellow. Wings hyaline, the stigma and veins brown-black.

*Type*.—Cat. No. 7259, U.S.N.M.

*Locality*.—Gifu. Described from two specimens, No. 47, received from Mr. Y. Nawa.

**Tribe IX. PORIZONINI.**

**Genus TEMELUCHA Förster.**

**TEMELUCHA JAPONICA, new species.**

*Female*.—Length 7.5 to 8 mm. Head yellowish, with the occiput and a spot on vertex inclosing the ocelli black; the eyes brown; the thorax brownish yellow, with a large oblong spot on the middle of the mesonotum anteriorly, the furrow across base of the abdomen, and an oblong spot at base of the metanotum black; the front and middle coxæ and trochanters, and the basis of the tarsi are yellowish white; tips of hind tibiæ and the three last joints of tarsi are black; abdomen brownish yellow, the petiole basally, blotches at base of the second

and third segments, and the sheaths of the ovipositor being black. Wings hyaline, the stigma light brown.

*Type*.—Cat. No. 7260, U.S.N.M.

*Locality*.—Swatow, China, and Japan (Mr. A. Koebele).

### Tribe X. PRISTOMERINI.

Genus PRISTOMERUS Holmgren.

PRISTOMERUS CHINENSIS, new species.

*Female*.—Length 6.5 mm.; ovipositor nearly as long as the abdomen. Black; the mandibles, except teeth, and the tegulæ are white; the clypeus, the two basal joints of antennæ, the ridge of the prosternum, the hind angles of the pronotum, the legs, except hind coxæ and the apex of the hind tibiæ, which are blackish, and the abdomen, except most of the petiole above, the second dorsal segment, most of the third dorsal segment, and the sheaths of the ovipositor, which are black, are testaceous. Wings hyaline.

*Type*.—Cat. No. 7261, U.S.N.M.

*Locality*.—Swatow, China (Mr. A. Koebele).

### Tribe XI. PLECTISCINI.

Genus ATELEUTE Förster.

ATELEUTE PALLIDIPE, new species.

*Male*.—Length 2.5 mm. Black and shining, the two basal joints of the antennæ, the second with a pale annulus at apex, and the abdomen toward apex of the first segment and on the second, with a rufopiceoris tinge; flagellum brown-black, with short hairs; legs flavotestaceous, the front and middle coxæ and trochanters paler yellowish; all the tarsi are very long, longer than their tibiæ. The abdomen is long, much longer than the head and thorax united, slender and depressed, the sides nearly parallel. Wings hyaline, the stigma and costal vein brown, the internal veins paler.

*Type*.—Cat. No. 7262, U.S.N.M.

*Locality*.—Japan (A. Koebele).

### Family LXXVI. ALYSIIDÆ.

Genus PHÆNOCARPA Förster.

PHÆNOCARPA FORMOSÆ, new species.

*Male*.—Length 2.1 mm. Brownish yellow, the head paler yellowish, the metathorax and the abdomen darker brown; eyes dark brown; clypeus, tegulæ, front coxæ and trochanters, the middle coxæ at apex and the first joint of their trochanters, and the first joint of hind trochanters, white; rest of legs and the first two joints of the antennæ

pale yellowish, the flagellum brown, becoming blackish toward apex. Wings hyaline, the stigma and basal nervure brown, the other veins pale.

*Type*.—Cat. No. 7263, U.S.N.M.

*Locality*.—Formosa (A. Koebele).

Genus *KAHLIA* Ashmead.

*KAHLIA SECUNDA*, new species.

*Female*.—Length 4.5 mm. Black and shining; mandibles red with black teeth; palpi, tegulae, and more or less of the trochanters yellowish-white; rest of legs mostly testaceous, the tips of hind femora, apical third of hind tibiae and basal two joints of hind tarsi except at tips, dark brownish or fuscous; wings hyaline, the veins blackish, the lanceolate stigma, mostly rufous or testaceous within, the stigmal vein originating near its apex and extending to the apical margin of the wing, making the marginal cell very large.

*Type*.—Cat. No. 7264, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura).

Family LXXVIII. BRACONIDÆ.

Subfamily I. APHIDIINÆ.

Genus *EPHEDRUS* Haliday.

*EPHEDRUS JAPONICUS*, new species.

*Female*.—Length 1.6 to 2 mm. Polished black; mandibles, palpi and legs honey-yellow, the hind coxæ dusky basally; abdomen mostly black, but more or less brownish piceous toward base, the petiole sometimes yellow and about three times as long as wide. Antennæ 11-jointed, black, the first two joints more or less testaceous, the third with a yellow annulus at base, about four times as long as thick. Wings hyaline, the venation brownish, the recurrent nervure joining the second cubital cell just behind the first transverse cubitus.

*Male*.—Differs from the female in having the antennæ longer, 16-jointed, the flagellar joints being not much more than twice as long as thick; the hind femora and tibiae, except at base, are rufo-piceous; while the abdominal petiole is black.

*Type*.—Cat. No. 7265, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). One male and 9 female specimens bred from an Aphis.

Genus *ACLITUS* Förster.

This genus has not been recognized since it was briefly characterized by Doctor Förster in 1862. I have recognized all of Förster's genera, although Rev. T. A. Marshall ignores them and has apparently "lumped" them all under *Aphidius* Nees and *Trioxys* Haliday.

This genus is closely allied to *Aphidius* Nees, but differs decidedly

in several particulars. The radius is always much longer, the parapsidal furrows distinct, the metathorax emarginate behind, the second dorsal abdominal segment is very large, while the sheaths of the ovipositor are broad and compressed.

**ACLITUS NAWAII**, new species.

Plate XV, fig. 3.

*Female*.—Length, 5.1 mm. Black, with the face, the orbits, the scutellum, the base of abdomen, the extreme apex of the long petiole, an oblique spot on the sides of the second segment and the sheaths of the ovipositor, testaceous; legs testaceous, the middle and hind femora tibiae and tarsi darker or brownish. The antennae are filiform, 24-jointed, the scape oval, large and stout, the pedicel much narrower, wider than long, the flagellum gently tapering off toward apex, the joints not more than twice as long as thick. The head and thorax are smooth and shining, the parapsidal furrows are punctate and meet posteriorly before attaining the base of the scutellum; the lateral lobes being shagreened anteriorly; the metathorax is rugulose, deeply emarginate behind, and with a median carina, which is forked at apex. The abdomen is lanceolate and terminates in a broad, compressed ovipositor, the length of the basal joint of the hind tarsi; the petiole is long, gradually dilated posteriorly and longitudinally striated.

*Male*.—Length 4.5 mm. Agrees fairly well with the female, except that the abdomen is clavate, entirely black, except the suture between the first and second segments, while the antennae are 30-jointed.

*Type*.—Cat. No. 7266, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). One male and 2 female specimens were sent, bred from a large Aphis, which, judging from the dry pupa skins, I identified as a species of *Lachnus*, or certainly a genus in the subfamily *Lachninae*.

**Genus APHIDIUS** Nees.

**APHIDIUS GIFUENSIS**, new species.

*Female*.—Length 2.5 mm. Head and thorax above, except the scutellum laterally and the metathorax, polished black, rest of thorax testaceous; abdomen long lanceolate, piceous, the petiole yellowish, the incisions of the segments yellow or testaceous, or sometimes yellow, with dusky transverse marks on segments 2 to 6; legs, including all coxae, honey-yellow; antennae long, 17-jointed, the first two joints and base of the third, yellow, rest of the joints brown-black, joints 3 to 16 about equal in length, nearly three times as long as thick. Wings hyaline, the stigma and the veins, except the basal nervure, brown, the basal nervure black.

*Type*.—Cat. No. 7267, U.S.N.M.

*Locality*. (Gifu (Y. Nawa). Two specimens bred from an unknown Aphis.

**APHIDIUS JAPONICUS, new species.**

*Female*.—Length 4.8 mm. Head, sutures of scutellum, the metathorax and abdomen, except the petiole beneath and the apex of the second segment, black and shining, rest of thorax and the legs, except the two last joints of tarsi which are dusky, yellow. The antennæ are long, filiform, 22-jointed, the first two joints more or less yellowish, the following joints black or brown-black; joints 6 to 21 only about twice as long as thick, joints 3 to 5 a little longer. Wings hyaline, the stigma and veins light brownish, the basal nervure blackish.

*Male*.—Length 4 mm. Agrees well with the female, except that the mesothoracic lobes are sometimes dusky, the antennæ longer, 24-jointed, while the abdomen beneath, the basal half of the third dorsal segment, and sometimes the sutures 4 and 5 are yellow.

*Type*.—Cat. No. 7268, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). One female and 3 male specimens bred from an Aphis.

**APHIDIUS LACHNIVORUS, new species.**

*Male*.—Length 3.6 mm. Black and shining; the mesonotal furrows are more or less distinct, the surface on each side, especially posteriorly, opaquely roughened, while between them is a more or less distinct median furrow. The antennæ are long, 26-jointed, the joints of the flagellum at least twice as long as thick; legs testaceous, the hind coxæ and femora black, the hind tibiæ, except at base, fuscous; the metanotum has a transverse carina bounding the truncature, but is not areolated, and there is a median furrow extending from the scutellum to the carina. The abdomen is elongate, shining black, except a yellow spot at the apex of the second dorsal segment; the first segment alone is faintly aciculated basally.

*Type*.—Cat. No. 7269, U.S.N.M.

*Locality*.—Nikko (A. Koebele). One specimen labeled from *Lachnus* sp. on Larch.

**APHIDIUS AREOLATUS, new species.**

*Female*.—Length 2 mm. Polished black without parapsidal furrows, the metathorax with five distinct areas, the areola or middle one, diamond shaped. The antennæ are 13-jointed, the first joint of the flagellum about thrice as long as thick, a little longer than the second, the following very gradually decreasing in length, the penultimate joint being only a little longer than thick, the last, or club joint, large, ovate, longer than the first; legs brownish yellow, the incision of the joints paler; abdomen lanceolate, longer than the head and thorax united, black, except the base and apex of the petiole and a spot at apex of the second segment which are yellowish; the petiole is shagreened or roughened, otherwise the abdomen is smooth and shining; wings hyaline, the stigma and veins light brown.

*Male*.—Agrees in color with the female, but differs in having the antennæ longer, 19-jointed, the joints of the flagellum being fully twice as long as thick, or even a little longer.

*Type*.—Cat. No. 7270, U.S.N.M.

*Locality*.—Japan. Described from 2 female and 5 male specimens, labeled No. 1268, and bred by Mr. Albert Koebele from an unknown *Aphis*.

Genus *LYSIPHLEBUS* Förster.

*LYSIPHLEBUS JAPONICUS*, new species.

*Female*.—Length 2 mm. Head, dorsum of mesonotum, the scutellums, and the dorsum of the abdomen, except the petiole and suture 2, and sometimes one or two of the other sutures, black; basal 3 or 4 joints of the antennæ, the legs, and the abdomen, except as noted, yellow. The antennæ are 13-jointed, black or brown, black from the fifth joint; joints 3 to 6 are about thrice as long as thick, those beyond a little shorter. Wings hyaline, the stigma and veins light brownish.

*Male*.—Agrees well with the female, except that the antennæ are longer, 17-jointed, and brown-black, except the first two joints; the base of the second dorsal abdominal segment, as well as the petiole, is yellow.

*Type*.—Cat. No. 7271, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). Three specimens, 2 females and 1 male, bred from an unknown *Aphis*.

Subfamily IV. METEORINÆ.

Genus *METEORUS* Haliday.

*METEORUS JAPONICUS*, new species.

*Female*.—Length 4.4 mm. Head, except the stemmaticum, and the thorax, except the parapsidal furrows, the depression in front of the scutellum, the foveæ at base of the scutellum, the sutures surrounding same, and the metathorax entirely, which are black, brownish-yellow; abdomen black, the second segment brownish-yellow; legs yellowish. The antennæ are long, about 30-jointed, brown, the 4 or 5 basal joints of the flagellum being about *four* times as long as thick. Wings hyaline, the veins light brown, the costal vein and the stigma within blackish. The first segment of the abdomen is longitudinally striate, the others smooth and shining, the ovipositer about two-thirds the length of the abdomen.

*Type*.—Cat. No. 7272, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). Three female specimens, No. 53, evidently bred from a *Lepidopteron*.

## Subfamily V. MACROCENTRINÆ.

## Genus MACROCENTRUS Curtis.

## MACROCENTRUS GIFUENSIS, new species.

*Female*.—Length 4.5 mm.; ovipositor longer than the whole insect. Head black; thorax brownish-yellow, the metathorax dusky or brownish; abdomen above brown or blackish, sometimes paler at the sutures, variable, the first, second, and third segments longitudinally striated; antennæ very long, brownish-yellow, becoming dusky toward apex, 40 or more jointed, the joints dusky at apex, appearing annulated; legs, including coxæ, yellow. Wings hyaline, the veins brownish, the stigma with a large dark brown blotch within.

*Type*.—Cat. No. 7274, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). Two specimens.

## Subfamily IX. CHELONINÆ.

## Genus PHANEROTOMA Wesmael.

## PHANEROTOMA FLAVA, new species.

*Female*.—Length 7 mm. Uniformly brownish-yellow; eyes and ocelli black; apical half, or nearly, of the wings smoky, the basal half hyaline; antennæ longer than the body, brown-black, the flagellar joints long, about five times as long as thick. The wings have the costæ to the parastigma, the median and submedian veins, and the basal and recurrent nervures yellow, the rest of the veins, with the parastigma and stigma being black.

*Type*.—Cat. No. 7276, U.S.N.M.

*Locality*.—Japan (A. Koebele). This is one of the largest species yet discovered in the genus.

## Genus ASCOGASTER Wesmael.

## ASCOGASTER ATAMIENSIS, new species.

*Female*.—Length 4 mm. Black, subopaquely punctate, with a sparse whitish pubescence, the base of the abdomen with elevated, longitudinal lines, the palpi pale, the two basal joints of the antennæ and the legs, except the coxæ, tips of hind tibiæ and more or less of the middle and hind tarsi, except basal joint, which are black, or dark fuscous, are ferruginous, the flagellum brown becoming dusky toward apex. Wings hyaline, the parastigma and stigma dark brown, the veins testaceous, tinged with brown.

*Type*.—Cat. No. 7275, U.S.N.M.

*Locality*.—Atami (A. Koebele).

## Subfamily XII. MICROGASTERINÆ.

## Genus GLYPTAPANTELES Ashmead.

## GLYPTAPANTELES POLITUS, new species.

*Female*.—Length 3 mm. Black, shining, and impunctate, except some sparse, faint punctures on the thorax anteriorly; the antennæ are longer than the body, black or brown-black, except the scape, which is more or less brownish-yellow basally and beneath; ocelli honey-yellow; the legs, except the hind coxæ and the abdomen at sides and beneath, are yellow; the metathorax is smooth, without a median carina; the abdomen is smooth, shining, and impunctate, the plate of the first segment is narrowed toward apex and about two and one-half times as long as wide at base, the second segment is a little shorter than the third, with two oblique grooved furrows that converge anteriorly. Wings hyaline, the stigma blackish, the veins, except the costæ toward apex, pale.

*Male*.—Length 2.5 mm. Antennæ wholly black, the apex of hind femora and tibiæ fuscous, their tarsi subfuscous, the thorax anteriorly more distinctly finely punctured, the metathorax finely wrinkled; otherwise similar to the female.

*Type*.—Cat. No. 7278, U.S.N.M.

*Locality*.—Gifu (N. Nawa). Three specimens, No. 56.

## GLYPTAPANTELES MINOR, new species.

*Female*.—Length 2 mm. Agrees well with *G. politus*, except that it is smaller with the antennal scape, except narrowly at apex, and the pedicel yellow, the stigma and stigmal vein brown, the three terminal ventral segments black or piceous, while the hind tibiæ are fuscous at apex.

*Type*.—Cat. No. 7279, U.S.N.M.

*Locality*.—Gifu (N. Nawa). Four specimens, No. 57.

## GLYPTAPANTELES FEMORATUS, new species.

*Male*.—Length 1.8 mm. Black and shining; legs brown-black, with the front legs, apex of middle femora and their tibiæ and tarsi, and the basal third of hind tibiæ, yellow, the hind tarsi subfuscous, more or less yellowish beneath; antennæ black, longer than the body, the first joint of the flagellum about two and one-half times as long as thick, shorter than the second or third, but stouter; the abdomen is smooth and shining, with the first and second ventral segments yellow; the plate of the first dorsal segment has the hind angles rounded; the second segment is a little shorter than the third and has two converging grooved lines from its basal middle.

*Type*.—Cat. No. 7280, U.S.N.M.

*Locality*.—Gifu (N. Nawa). Two specimens, No. 59.

**GLYPTAPANTELES (APANTELES) JAPONICUS, new species (Ashmead).**

*Female*.—Length, 2.8 to 3 mm. Black, shining; face, thorax, and hind coxæ very finely punctulate; head above and posteriorly polished, impunctate; labrum and mandibles honey-yellow; palpi white; scape, pedicel, tegulæ and legs, except hind coxæ which are black, brownish-yellow; flagellum black or brown-black. Wings hyaline, the stigma and subcostal vein brown, other veins pallid. Metathorax smooth without areas or carinæ. Abdomen beneath, except the large plow-share shaped ventral valve, and the lateral margins of dorsal segments 1-5 brownish-yellow or ferruginous; the plate of first segment lanceolate, more than three times as long as wide, gradually narrows toward apex; second segment shorter than the third, with two oblique impressed lines; plate and all segments smooth, impunctate.

*Male*.—Length, 2.2 to 2.5 mm. Agrees well with female in colorational detail, but the antennæ are much longer than the body, the abdomen is smaller and shorter, while the second abdominal segment is about twice as long as the third.

*Type*.—Cat. No. 3457, U.S.N.M. Described from many specimens in National Museum, Acc. No. 23417, received July 30, 1890, from Rev. H. Loomis, of Yokohama, Japan, who bred them from the larva of *Ocneria dispar*, and from many additional specimens received by Dr. L. O. Howard from Prof. A. H. Kirkland, who also received them from Rev. H. Loomis.

The species belongs in Marshall's Section IV, of *Apanteles*, and comes very close to two European species—*Apanteles vitripennis* Curtis and *A. fulvipes* Haliday, from both of which it is readily distinguished by the impunctate metanotum, the difference in the plate of the first abdominal segment, by having the first and second segments smooth, not aciculated, and by the venter being entirely brownish-yellow.

**GLYPTAPANTELES NAWAII, new species.**

*Female*.—Length, 2 mm. Black and shining, but with the head and thorax finely punctulate, the scutellum polished, impunctate, the metathorax finely rugulose, with a median carina. The antennæ are about as long as the body and black; legs brownish-yellow, the hind coxæ black, the front and middle coxæ usually with a slight fuscous spot at base only, the hind femora at extreme apex and the tips of their tibiæ faintly fuscous. The abdomen is black and shining, except ventral segments 1 and 2 which are yellowish; the plate of the first dorsal segment and the second segment are finely sculptured; the plate of the first is about two and one-half times as long as wide, a little wider at apex than at base; the second segment is shorter than the third with a

median ridge, rest of the segments smooth, polished. Wings hyaline, the stigma and first branch of the radius brown-black, the other veins light brownish.

*Male*.—Agrees with the female, except that the antennæ are somewhat longer, the front and middle coxæ wholly yellow, while the second dorsal segment of the abdomen is much shorter, or only about half as long as the third.

*Type*.—Cat. No. 7281, U.S.N.M.

*Locality*.—Gifu (N. Nawa). Three specimens labeled No. 54.

Genus MICROPLITIS Forster.

MICROPLITIS ATAMIENSIS, new species.

*Male*.—Length, 2.5 mm. Black, closely punctate and pubescent, the head above on the vertex smooth and shining, the occiput closely punctulate; ocelli pale yellowish; antennæ, except the minute pedicel, entirely black; legs mostly brownish-yellow, but with all coxæ, the first joint of all trochanters, a spot at base of front femora, the basal half of middle femora, the hind femora entirely, the apical third or more of hind tibiæ, and the hind tarsi black; basal two-thirds of wings sub-fuscous, the apical third and a fascia extending across from the parastigma hyaline, the stigma and veins dark brown. Abdomen, except the first segment, which is rugose-punctate, smooth and shining.

*Type*.—Cat. No. 7285, U.S.N.M.

*Locality*.—Atami (A. Koebele). One specimen.

MICROPLITIS SAPPOROENSIS, new species.

*Female*.—Length, 4 mm. Black, closely punctate and pubescent, the head smooth and shining on vertex, rather densely clothed with a fine whitish pubescence in front; palpi pale; clypeus, mandibles, and legs, except the hind coxæ, a spot at apex of hind femora, and most of the hind tarsi brownish-yellow; the hind coxæ, a spot at apex of hind tibiæ, and the hind tarsi, except base of the first joint, black; ventral segments 1 and 2 and base of 3, yellow; the abdomen, except the first segment, which is sparsely, finely punctate, is smooth, shining, and impunctate. Wings hyaline, the parastigma, the stigma, except the basal half, and the internal veins brownish or fuscous; the basal half, or nearly, of the stigma and the longitudinal veins before the basal nervure yellowish.

*Type*.—Cat. No. 7285, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura). One female specimen, labeled No. 39.

## Subfamily XV. BRACONINÆ.

## Genus MELANOBRACON Ashmead.

## MELANOBRACON TIBIALIS, new species.

*Female*.—Length, 7 to 7.5 mm.; ovipositor about two-thirds the length of the abdomen. Brownish-yellow, smooth, and shining; head quadrate, the eyes large, brown-black; the antennæ, except the two basal joints, joints 2 to 5 of middle tarsi, and the hind tibiæ and tarsi, except a pale annulus at base of tibiæ, are black. Wings subhyaline, or slightly smoky, with the stigma and veins, except the submedian vein, entirely, and the costal and subcostal veins at base, which are yellow, are black. The abdomen has a longitudinal furrow each side of the first and second dorsal segments, and also on the second a triangular elevation from its base, while the suture between the second and third segments is rather deep.

*Type*.—Cat. No. 7287, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). Three specimens, labeled No. 49.

## Genus MACRODYCTIUM Ashmead.

## MACRODYCTIUM FLAVIPES, new species.

*Female*.—Length, 3.5 mm.; ovipositor about as long as the abdomen. Polished black; the first two joints of the antennæ, a small annulus at the base of the third joint, and the legs, except the last joint of the front and middle tarsi, the extreme apex of hind tibiæ, and the hind tarsi, which are fuscous, are yellowish, or brownish-yellow; the second abdominal segment is longitudinally striate on each side of the triangular ridge or plate at base. Wings hyaline, the stigma and veins brown, the tegulæ and the longitudinal veins basally pale yellowish.

*Type*.—Cat. No. 7288, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura). One specimen, labeled No. 32.

## Genus CHELONOASTRA ASHMEAD.

## CHELONOASTRA KOEBELEI, new species.

Plate XIV, fig. 3.

*Female*.—Length 5.5 to 6 mm.; ovipositor from a half to two-thirds the length of the abdomen. Black, the head and thorax smooth and shining, the abdomen opaque, concave beneath as in *Chelonus* Jurine, the first three segments coarsely regulo-se, the second and third closely united and occupying most of the surface of the abdomen, the fourth and fifth segments very short, shagreened. The head as viewed from above is obtrapezoidal, the face sparsely punctate, pubescent, the eyes

hairy. Wings fuliginous, the stigma and veins brown-black, the venation as in *Bracon* Fabricius.

*Type*.—Cat. No. 7287, U.S.N.M.

*Locality*.—Atami (A. Kochele). Many specimens.

**CHELONOASTRA PLEURALIS, new species.**

*Female*.—Length 3 to 3.5 mm.; ovipositor about the length of the abdomen. Brownish-yellow; the stemmaticum, the eyes, the occiput more or less, the crenulate furrow at base of scutellum, the sutures of same, sometimes the disks of the mesothoracic lobes but not always, the mesopleura, the metathorax, and usually the disks (and sometimes the greater part except laterally) of the first, second, and third abdominal segments, and spots at the extreme lateral margins of the fourth and fifth segments black; the hind coxæ, the femora, except at both ends, the tibiæ, except at base, and the tarsi, are black, or dark fuscous. Wings subfuscous, the veins brownish, the stigma somewhat pale within. Abdomen sculptured much as in previous species.

*Type*.—Cat. No. 7290, U.S.N.M.

*Locality*.—Atami (A. Koebele). Many specimens.

**Genus MICROBRACON Ashmead.**

**MICROBRACON JAPPELLUS, new species.**

*Female*.—Length 2.5 mm.; ovipositor about as long as the abdomen. Brownish-yellow, smooth and shining; eyes, the metathorax above, the first segment of abdomen, a median stripe on the second, and the disks of the fourth and fifth, more or less, black; antennæ brown, the pedicel yellowish; legs wholly yellowish, immaculate. Wings hyaline, with a grayish tinge, the veins and stigma, except along the outer margin, yellowish.

*Type*.—Cat. No. 7291, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumura). One specimen, labeled No. 36.

**Genus EUUROBRACON Ashmead.**

**EUUROBRACON PENETRATOR (Smith.)**

Plate XV, figs. 1, 2.

*Bracon penetrator* SMITH, Proc. Zool. Soc., London, 1877, p. 413, female.

*Bracon yokohama* DALLA TORRE, Cat. Hym., IV, 1898, p. 295.

*Euurobrakon penetrator* ASHMEAD, Proc. U. S. Nat. Mus., XXIII, 1900, p. 140.

*Male*.—Length 19 mm. Flavo-ferruginous, the head a little paler; legs yellow, the hind pair, except coxæ and trochanters, black or blackish; antennæ black; wings yellowish hyaline, the apical margins broadly fuliginous, the front pair with a spot inclosing the basal

nervure, a spot at base of marginal cell, and a spot in the second discoidal cell black.

*Type*.—Male. Cat. No. 7292, U.S.N.M.

*Locality*.—Japan (Doctor Mitsukuri).

#### Genus ZAGLYPTOGASTRA Ashmead.

This genus was characterized briefly in my Classification of the Ichneumon Flies, 1900, page 137, where I placed it next to *Iphiaulax* Förster on account of similarity of the structure of the head, thorax, and abdomen, but it really belongs to my tribe *Eurobraconini*, as the submedian cell in the front wings is longer than the median.

#### ZAGLYPTOGASTRA ABBOTTII, new species.

Plate XV, fig. 4.

*Female*.—Length about 18 mm.; ovipositor 17 mm. Uniformly brownish yellow, the eyes and the flagellum brown-black, the sheaths of the ovipositor black, the wings yellowish hyaline, with a black spot at the origin of the radius, and the tips of the hind wings dusky. The head and thorax are highly polished impunctate, the forehead concave, the scape fully thrice as long as thick, truncate at apex and slightly narrowed and rounded at base, originating from a distinct pedicellus, the tarsi longer than their tibiae, the abdomen strongly sculptured as in figure.

*Type*.—Cat. No. 8299, U.S.N.M.

*Locality*.—Trong, Lower Siam (Dr. W. L. Abbott).

#### Family XVI. RHOGADINÆ.

#### Tribe I. EXOTHECINI.

#### Genus XENOBIUS Förster.

#### XENOBIUS ALBIPES, new species.

*Female*.—Length 2 mm.; ovipositor hardly one-third the length of the abdomen. Light brownish-yellow, smooth and shining, except on the metathorax, the eyes, the dorsum of the metathorax, and the extreme base of the first abdominal segment being black; the antennæ are brownish, as long as the body, 22 or 23 jointed; palpi, tegulæ and legs ivory-white. Wings hyaline, the stigma and veins, except the median vein toward apex, and the basal nervure, pallid.

*Male*.—Length 1.5 mm. Agrees in every respect with the female, except the antennæ are a little longer and darker, with more joints, the abdomen smaller, and with the second segment whitish.

*Type*.—Cat. No. 7293, U.S.N.M.

*Locality*.—Atami (A. Koebele).

## Tribe III. RHOGADINI.

## Genus HETEROGAMUS Wesmael.

## HETEROGAMUS FASCIATIPENNIS, new species.

*Female*.—Length 6 mm. Dark brown, rugoso-punctate, opaque, the thorax above, except the scutellum, blackish, the mesosternum, the third abdominal segment and segments beyond, less coarsely punctured, the first and second segments with a median longitudinal carina, subequal in length and much longer than the third; eyes black; palpi fuscous, the sutures of the joints and the last joint paler; antennæ and legs brownish-yellow, the last tarsal joint black. Wings fuscous with a whitish or hyaline band across from the stigma, the stigma, except at apex, pale yellowish, the other veins dark fuscous; second cubital cell hardly longer than wide. The abdomen is considerably longer than the head and thorax united, gradually narrowed toward the base; the third segment, which is the widest and much wider than long, is almost twice as wide as the first segment at base, the first being more than twice as long as wide and a little longer than the second. The antennæ are broken off from the third joint, but were probably long and slender.

*Type*.—Cat. No. 7294, U.S.N.M.

*Locality*.—Sapporo (Doctor Matsumara). One specimen, labeled No. 16.

## HETEROGAMUS THORACICUS, new species.

*Female*.—Length 5.5 mm. Head and abdomen, except the venter, black; the clypeus, malar space and the thorax, except a dark stripe on the middle of the pronotum in the depression extending from in front of the tegulæ anteriorly, and the apex of the metathorax above, which are dusky, are light brownish-yellow; palpi white; legs, except the last joint of the tarsi, pale yellowish. Wings hyaline, the stigma and submedian vein yellow, the other veins fuscous; second cubital cell only about one-third longer than wide at base.

*Type*.—Cat. No. 7295, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumara). One specimen, labeled No. 25.

## Genus RHOGAS Nees.

## RHOGAS FUSCOMACULATUS, new species.

*Female*.—Length 3.5 to 4 mm. Ground color brownish-yellow; a large spot on face below insertion of antennæ, a spot inclosing the ocelli, the lateral mesothoracic lobes anteriorly, the disk of the middle lobe posteriorly, the upper half of the mesopleura, the metathorax, and the abdomen above, except a spot at apex of first segment medially, a large band down the center of the second, and a spot at the basal

middle of the third, are fuscous; the antennæ are brown, darker toward apex; the flagellar joints after the first about twice as long as thick, the first joint being nearly thrice as long as thick; legs, including coxæ, uniformly brownish-yellow. Wings hyaline; the stigma, except at apex within, from the origin of the cubitus, and the veins, yellow, the basal nervure more or less dusky; the second cubital cell is nearly twice as long as wide at base, a little narrower at apex than at base, the second transverse cubitus being whitish and distinctly shorter than the first.

*Type*.—Cat. No. 7296, U.S.N.M.

*Locality*.—Sapporo (Dr. S. Matsumara). One specimen, labeled No. 13.

**RHOGAS JAPONICUS, new species.**

*Male and female*.—Length 5.5 to 6 mm. Brownish-yellow; eyes, brown-black; a spot between ocelli; the disk of metathorax, the disk of first abdominal segment, more or less, and one or two spots toward apex of the abdomen, black; the antennæ are very long, slender, becoming more or less fuscous toward apex, yellowish basally for more than half their length, the joints of the flagellum about three times as long as thick. Wings hyaline, the veins and stigma mostly yellow, the latter, however, with a large spot toward apex, and the basal nervure and the first abscissa of the radius, fuscous. The male is the smaller and differs from the female in having no fuscous spots at apex of abdomen, and in having the stigma of the front wings nearly wholly yellow; with only a trace of the fuscous spot at apex.

*Type*.—Cat. No. 7297, U.S.N.M.

*Locality*.—Gifu (Y. Nawa). Three specimens, labeled No. 51.

**Tribe IV. DORYCTINI.**

**Genus ISCHIOGONUS Wesmael.**

**ISCHIOGONUS HAKONENSIS, new species.**

*Female*.—Length, 7 mm.; ovipositor about as long as the abdomen. Black and shining; the hind orbits, a spot before insertion of each antenna, the cheeks, the mandibles, except teeth, the last segment of abdomen, and the legs, except a black spot at apex of all femora, the middle and hind tibiæ toward apex, and the tarsi, which are fuscous, are brownish-yellow; the palpi and tegulæ are yellowish-white; the antennæ are brown-black, with the scape reddish-brown beneath, the small ring-joint yellowish. Wings subfuscous, the veins black or brown-black, the stigma brownish-yellow, paler at base. The thorax is distinctly trilobed, the middle lobe short with a median furrow, the depression on the middle lobe posteriorly and on the lateral lobes in front of the scutellum is rugulose, the prothorax at the sides has some

raised lines, the mesopleura polished with a median depression, while the metathorax is rugulose, with two large smooth areas at base. The abdomen has the first segment and the second to the first transverse impressed line, rather coarsely longitudinally striated, the rest of the abdomen being smooth.

*Type*.—Cat. No. 7298, U.S.N.M.

*Locality*.—Hakone (A. Koebele). One specimen.

Subfamily XVII. SPATHIINÆ.

Tribe II. HORMIINI.

Genus CHREMYLUS Haliday.

CHREMYLUS JAPONICUS, new species.

*Female*.—Length 1 mm. Head black, shining, the thorax and last four joints of the antennæ brown-black, opaque, the abdomen with a reddish tinge, the rest of the antennæ and the legs pale yellowish. The metathorax is areolated, the upper hind angles briefly toothed, the areola lozengoidal, petiolate at base. Wings hyaline, the stigma and veins brown.

*Type*.—Cat. No. 7299, U.S.N.M.

*Locality*.—Atami (A. Koebele). One specimen.

ACANTHORMIUS, new genus.

This interesting new genus may be inserted in my table of genera, Classification of the Ichneumen Flies, 1900, page 148, as follows:

4. Subdiscoidal nervure interstitial.

Recurrent nervure received by the second cubital cell.

Abdomen normal, with at least 6 segments, not longitudinally striated.

*Hormius* Nees.

Abdomen abnormal, with only 3 segments, all longitudinally striated, the third with the hind angles produced into long, acute spines, nearly the length of the ovipositor (female) ..... *Acanthormius*, new genus.

ACANTHORMIUS JAPONICUS, new species.

*Female*.—Length, 1.8 mm.; ovipositor about one-third the length of the abdomen. Head and thorax pale brownish, the abdomen dark brown above, longitudinally striated, beneath pale yellowish; head smooth and shining, brownish yellow; palpi, tegulae, coxae, and trochanters whitish or yellowish white; rest of legs pale yellowish; metathorax areolated.

*Type*.—Cat. No. 7300, U.S.N.M.

*Locality*.—Hakone, (A. Koebele). One specimen.

EXPLANATION OF PLATES.

PLATE XII.

- FIG. 1. *Matsumuraius grandis* Ashmead, male.  
 2. *Rhexidermus japonicus* Ashmead, female.  
 3. *Proterocryptus nawai* Ashmead, female.

PLATE XIII.

- FIG. 1. *Hemiephialtes glyptus* Ashmead, female.  
 2. *Apechthis orbitalis* Ashmead, female.  
 3. *Nesopimpla naranyæ* Ashmead, female.

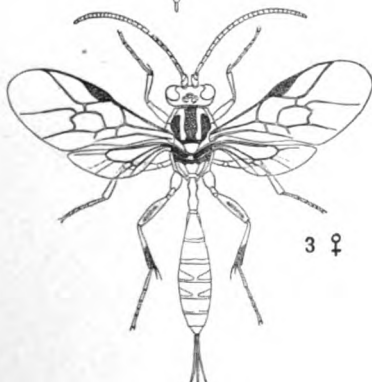
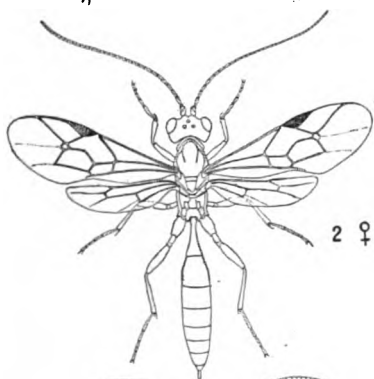
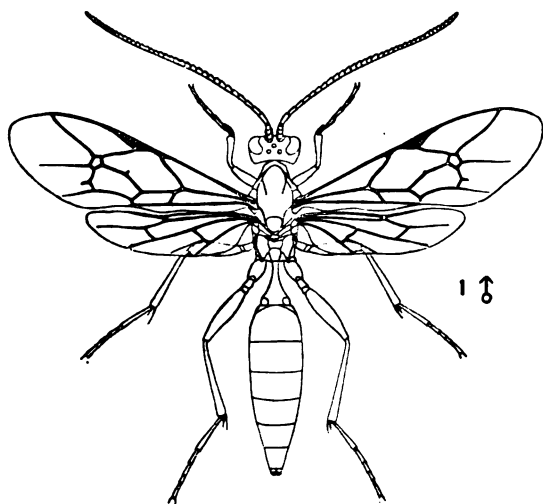
PLATE XIV.

- FIG. 1. *Calliclisis incerta* Ashmead, male.  
 2. *Nawaia japonica* Ashmead, female.  
 3. *Chelonogastra koebelei* Ashmead, female.

PLATE XV.

- FIG. 1. *Euurobracon penetrator* (Smith), female.  
 2. *Euurobracon penetrator* (Smith), male.  
 3. *Aclitus nawai* Ashmead, female.  
 4. *Zaglyptogastra abbottii* Ashmead, female.

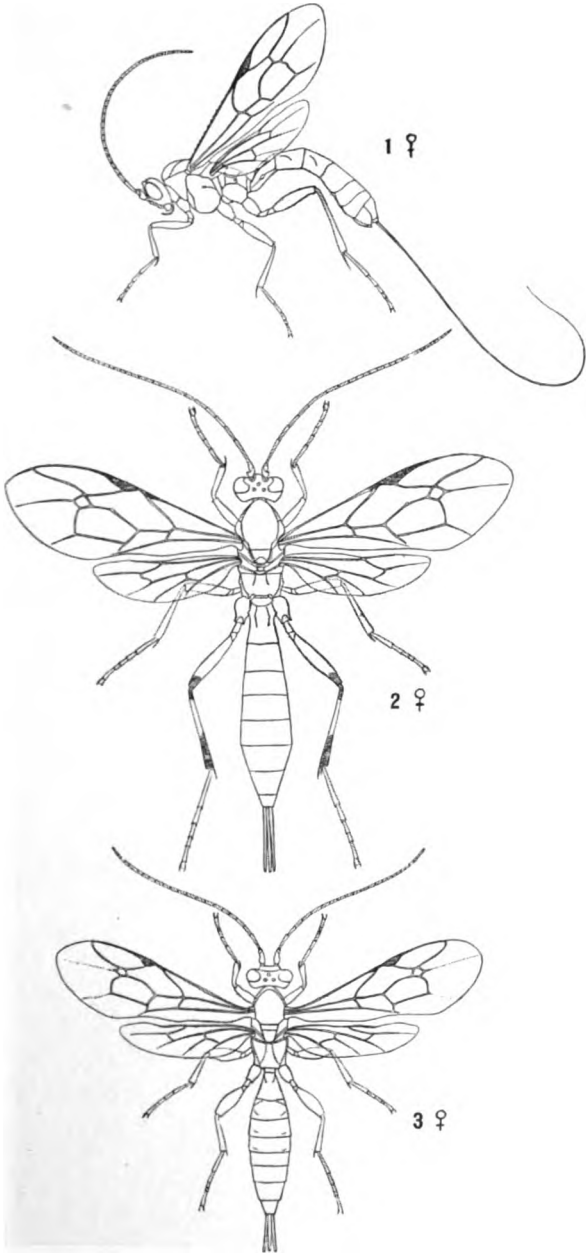




**NEW JAPANESE HYMENOPTERA.**

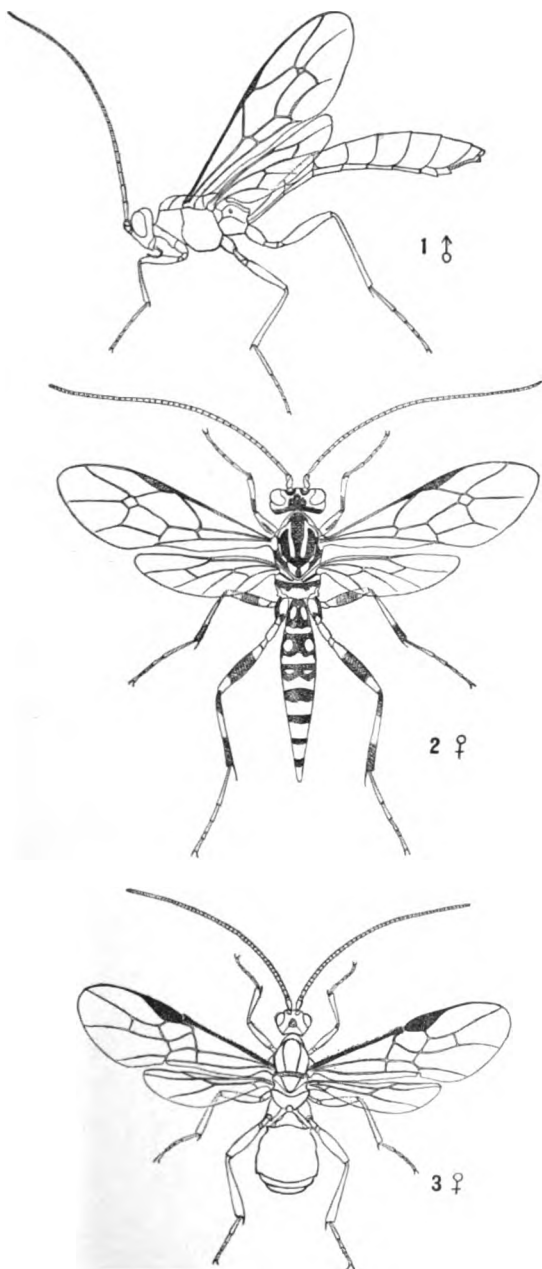
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NEW JAPANESE HYMENOPTERA.  
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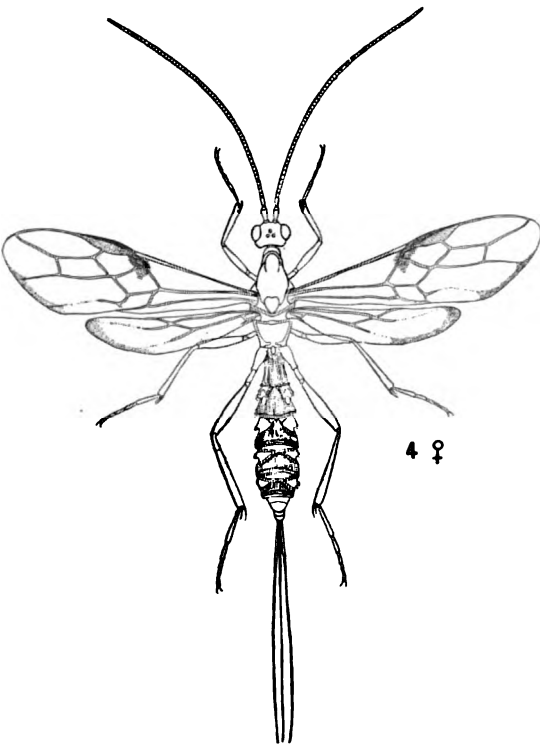
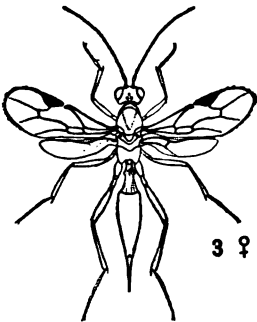
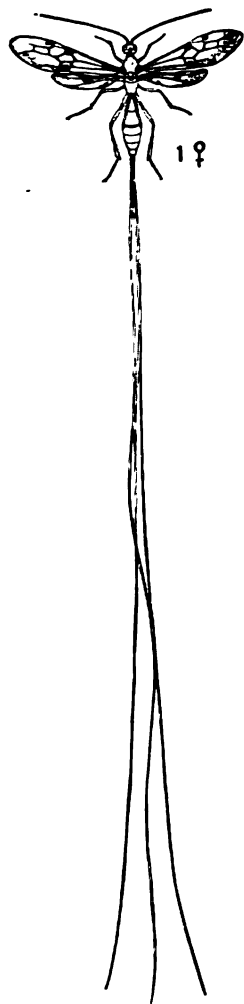




NEW JAPANESE HYMENOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 201.





NEW JAPANESE HYMENOPTERA.  
FOR EXPLANATION OF PLATE SEE PAGE 201.



# THE OSTEOLOGY OF SINOPA, A CREODONT MAMMAL OF THE MIDDLE EOCENE.

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By WILLIAM DILLER MATTHEW,  
*Of the American Museum of Natural History.*

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## INTRODUCTION.

During the summer of 1902 the writer, assisted by Mr. Walter Granger, spent some weeks in the Bridger basin in southwestern Wyoming, with the object of determining faunal levels in the Bridger formation. This work was undertaken under the auspices of the U. S. Geological Survey and under direction of Prof. H. F. Osborn, palaeontologist of the Survey. Although collecting was not the principal object of the expedition, a number of fossils were secured, among which the most important was the finely preserved and nearly complete skeleton of *Sinopa*, found by Mr. Granger. The specimen was extracted from the matrix by Mr. Charles Christman and very skillfully prepared for mounting by Mr. Albert Thomson, both of the American Museum of Natural History. I owe the privilege of describing this rare specimen, which is one of the most perfect fossil skeletons ever discovered in an Eocene formation, to the courtesy of Dr. G. P. Merrill, Head Curator of Geology of the National Museum, and of my honored teacher and friend, Professor Osborn.

The genus *Sinopa* was the first carnivore to be described from the Eocene of this continent. It is the most abundant and characteristic creodont in the Bridger formation and is represented by a number of well-defined species in the Lower and Middle Eocene of North America. It has also been found in the Egerkingen beds of Switzerland, probably Middle Eocene, along with the related genus *Proviverra*. It is not known to occur in any Upper Eocene beds either in Europe or America, but in the Phosphorites of France, of approximately Lower Oligocene age, the closely allied genus *Cynohyænodon* is quite common.

## LIST OF SPECIES OF SINOPA AND ALLIED GENERA.

[The names and dates are those of the original description. Indeterminate species are placed in brackets.]

1862. *Proviverra typica* Rüttimeyer. Egerkingen beds, Switzerland.  
 June 21, 1871. [*Triacodon fallax* Marsh.] Bridger formation, Wyoming.  
 July 11, 1871. *Sinopa rapax* Leidy. Bridger formation, Wyoming.  
 July 29, 1872. [*Triacodon aculeatus* Cope.] Bridger formation, Wyoming.  
 Aug. 3, 1872. *Stypolophus pungens* Cope. Bridger formation, Wyoming.  
 Aug. 7, 1872. *Limnocyon agilis* Marsh. Bridger formation, Wyoming.  
 Aug. 7, 1872. *Stypolophus brevicaratus* Cope. Bridger formation, Wyoming.  
 Aug. 7, 1872. [*Stypolophus insectivorus* Cope.] Bridger formation, Wyoming.  
 Aug. 7, 1872. [*Triacodon grandis* Marsh.] Bridger formation, Wyoming.  
 Aug. 7, 1872. [*Triacodon nanus* Marsh.] Bridger formation, Wyoming.  
 1873. *Cynohyænodon cayluri* Filhol. Phosphorites, France.  
 1873. *Cynohyænodon minor* Filhol. Phosphorites, France.  
 1874. *Prototomus viverrinus* Cope. Wasatch formation, New Mexico.  
 1875. *Prototomus secundarius* Cope. Wasatch formation, New Mexico.  
 1875. *Prototomus multicuspis* Cope. Wasatch formation, New Mexico.  
 1875. *Prototomus strenuus* Cope. Wasatch formation, New Mexico.  
 1877. *Stypolophus hians* Cope. Wasatch formation, New Mexico.  
 1882. *Stypolophus whitæ* Cope. Wind River formation, Wyoming.  
 1892. [*Proviverra americana* Scott.] Bridger formation, Wyoming.  
 1901. *Sinopa opisthotoma* Matthew. Wasatch formation, Wyoming.  
 1902. *Sinopa major* Wortman. Bridger formation, Wyoming.  
 1902. *Sinopa minor* Wortman. Bridger formation, Wyoming.  
*Sinopa grangeri* infra. Bridger formation, Wyoming.

## HISTORY AND NOMENCLATURE.

*Proviverra* Rüttimeyer, type *P. typica*, was the first genus described. It was based upon the anterior part of a skull in fairly good preservation. The additional material referred to this genus is very incomplete and its identification doubtful.

*Sinopa* Leidy, type *S. rapax*, was based upon an incomplete lower jaw. The first mention of the genus includes about a half a page of description and the type was figured two years later. This specimen has since been mislaid, but Leidy's excellent figures enable us to identify more complete specimens in the American Museum collections and differentiate the genus from *Proviverra*. The skeleton described in this article represents a new species of *Sinopa*. *S. opisthotoma* Matthew also belongs here but is subgenerically distinct.

*Triacodon* Marsh, type *T. fallax*, described shortly before *Sinopa*, was founded upon the trigonid of a lower molar which may belong to *Sinopa*, *Uintacyon*, *Limnocyon*, or some other creodont or carnivore. It is quite indeterminate. Three other species have been referred to the same genus and are equally indeterminate.

*Stypolophus* Cope, type *S. pungens*, was based upon a part of the lower jaw of a species closely allied to *Sinopa rapax*, of which the genus is a synonym.

*Prototomus* Cope, type *P. viverrinus*, was based upon a palate and

fragments of the skeleton in bad preservation and was subsequently referred by its describer to *Stypolophus* (= *Sinopa*).

*Cynohyænodon* Filhol is nearly allied to *Sinopa* and *Proviverra*, but may be held as generically distinct from either. The type is a finely preserved skull, and other excellent material illustrates the genus.

The definitions will be as follows:

Family Hyænodontidæ. Carnassial teeth,  $M \frac{3}{4}$ .

I.  $M \frac{3}{4}$  absent, protocones and metaconids absent ..... *Hyænodon*

II.  $M \frac{3}{4}$  transverse.

A. Cusps massive, protocones and metaconids reduced, carnassials large, anterior molars small, transverse molar small. .... *Pterodon*

B. Cusps sharp, protocones and metaconids well developed, transverse molar larger. Molars of more equal size, with broad external cingula.

1. Paracone and metacone connate on  $M^{1-2}$ , metacone vestigial on  $M \frac{3}{4}$ .

a. No metaconid on  $P \frac{4}{5}$  ..... *Proviverra*

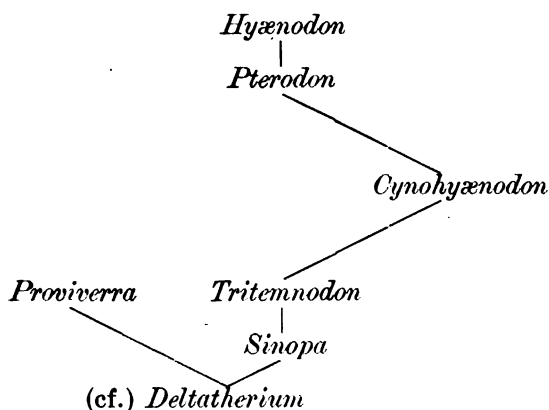
b. Metaconid on  $P \frac{4}{5}$  well developed; premolars long. ....

*Tritemnodon*, new genus.

c. Metaconid on  $P \frac{4}{5}$  well developed; premolars high .... *Cynohyænodon*

2. Paracone and metacone well separated on  $M^{1-2}$ , metacone well developed on  $M \frac{3}{4}$  ..... *Sinopa*

These genera show the different stages in the development of the highly specialized flesh-cutting teeth of *Hyænodon* from the comparatively primitive opossum-like teeth of *Sinopa*. Arranged according to cusp development, they stand thus:



This is in partial but not complete correspondence with their known geological occurrence, as follows:

| Name.                     | Eocene. |        |         |        | Oligocene. |         |
|---------------------------|---------|--------|---------|--------|------------|---------|
|                           | Basal.  | Lower. | Middle. | Upper. | Lower.     | Middle. |
| <i>Hyænodon</i> .....     |         |        |         | x      | x          | x       |
| <i>Pterodon</i> .....     |         |        |         | x      | x          |         |
| <i>Cynohyænodon</i> ..... |         |        |         | x      | x          |         |
| <i>Tritemnodon</i> .....  |         | x      | x       |        |            |         |
| <i>Proviverra</i> .....   |         |        | x       |        |            |         |
| <i>Sinopa</i> .....       |         | x      | x       |        |            |         |
| <i>Deltatherium</i> ..... | x       |        |         |        |            |         |

The genus *Sinopa* has been held to include *Stypolophus* and *Prototomus* of Cope, and until lately *Limnocyon* Marsh.<sup>a</sup> Wortman in 1902 showed that the type species of *Limnocyon* belongs to a distinct group of the Creodonta, but referred *L. agilis* Marsh to *Sinopa* and described the skull and parts of the skeleton from two finely preserved specimens. The more complete material of *S. rapax* in the American Museum collections, and the complete skeleton here described, show such considerable differences from *S. agilis* that it seems necessary to separate them generically, splitting up the genus *Sinopa* into two closely allied genera, each represented by a number of species in both Middle and Lower Eocene. The generic distinctions are clear enough in the Middle Eocene, but in the Lower Eocene the species are not clearly separable, and most of them show various combinations of the characters of the two groups. *Sinopa rapax* Leidy is the type of the first, and *Tritemnodon* (*Limnocyon*) *agilis* Marsh will stand as type of the second group. See figs. 1 and 2.

#### DESCRIPTION OF THE SKELETON.

The entire skeleton is preserved except one fore and one hind foot and the distal half of the tail, of which only a few fragments remain. Most of it is in remarkably fine preservation. As found in the rock, the greater part of the vertebral column, pelvis, and most of the limbs were articulated together; the skull and jaws and some limb or foot bones were scattered; and several anterior dorsals and cervicals and most of the ribs were scattered and more or less broken up and damaged. The bones were very little crushed, and the articulations of the vertebrae so perfect that the sequence of those found out of place could be accurately determined.

The skeleton compares for size and proportions with the civet. The skull is elongate and rather large. The limbs are small and moderately slender, the neck of moderate length, the trunk long and slim, the tail extremely long and powerful. The vertebral formula is C 7, D 13, L 7, S 3, C ? 29. The fore and hind feet are five-toed, the digits rather slender, not spreading, except the first, which is somewhat divergent but not reduced in length. The scaphoid lunar and centrale are separate.

#### DENTITION, DEFINITION, AND SPECIFIC DISTINCTIONS.

##### SINOPA GRANGERI, new species.

Somewhat larger and more robust than *S. rapax*, with more massive teeth and a diastema behind  $P_2$ . Skull about equal in size to *Tritemnodon agilis*, but shorter, considerably deeper in the facial region, with higher sagittal crest and deeper jaw. Premolars less compressed,

<sup>a</sup> Cope, Scott 1892, Matthew 1901.

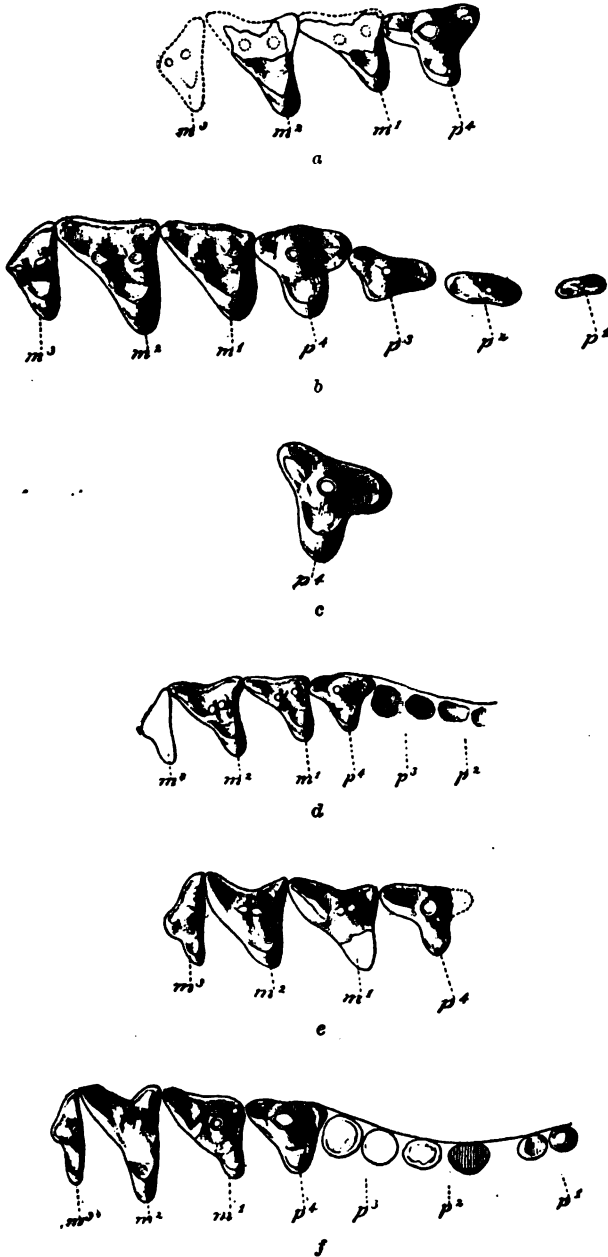


FIG. 1.—UPPER TEETH OF SPECIES OF SINOPA AND TRITEMNODON, NAT. SIZE, CROWN VIEWS. FROM THE SAME INDIVIDUALS AS THE LOWER TEETH SHOW IN FIG. 2.

a, *Sinopa rapax* Leidy, Am. Mus. Coll., No. 11535. b, *Sinopa grangeri*, new species. Type. Cat. No. 5341, U.S.N.M. Coll. c, *Sinopa major* Wortman, Am. Mus. Coll., No. 11538. d, *Sinopa minor* Wortman, Am. Mus. Coll., No. 11532. e, *Tritemnodon agilis* Marsh, Am. Mus. Coll., No. 11543. f, *Tritemnodon whitii* Cope, Am. Mus. Coll., No. 4781.

paracones and metacones of upper molars well separated, heels of lower molars much larger than in *T. agilis*, metacone on  $M^2$  well developed. Skeleton smaller with shorter limb-bones.

*Teeth.* (fig. 1*b*, 2*c*) Dentition  $\frac{3.1.4.3}{3.1.4.3}$ . Incisors small, transverse, canines slender and of moderate size. Premolars trenchant, moderately compressed,  $P^2$  two-rooted, but of subtriangular outline with rudimentary internal cusps.  $P^4$  three-rooted with large lunate internal cusp, small antero-external and larger postero-external basal cusps and massive conical protocone. Molars functionally resembling those of the opossum, but only three in number, with principal oblique and subordinate transverse shears, the upper ones of triangular outline, paracone and metacone of equal size and well separated, large lunate antero-internal protocone, and broad external cingular shelf.  $M^{1-2}$  sub-equal, with small paraconule and metaconule, parastyle small, metastyle extended into a strong shearing blade.  $M^3$  smaller, transverse, metacone well developed but smaller than paracone, no metastyle, parastyle extended into a short shearing blade, no metaconules. Lower molars of nearly equal size, but  $M_7$  smaller than the others, the trigonids high, of triangular form, paraconid and metaconid well developed, sub-equal, protoconid overtopping both. Heels basin-shaped, as large as the trigonids, except on  $M_3$ .

In *S. rapax* (fig. 1*a*, 2*a*) the internal cusps of  $P^4$  to  $M^3$  are more compressed and less broadly lunate, the principal cusp of  $P^4$  is less massive, the heels of the lower molars are smaller, and there is no diastema behind  $P_2$ . In *T. agilis* (fig. 1*e*, 2*f*) the internal cusps of the upper teeth are smaller and much more compressed,  $P^2$  is compressed and trenchant, the paracone and metacone are closely connate and of unequal size, metacone absent on  $M^2$ , heels of lower molars much smaller, metaconids greatly reduced, etc. In *T. whitiae* (fig. 1*f*, 2*g*) the inner cusps of the molars are extended inward, the metaconids well developed, but otherwise it is much as in *T. agilis*. The Lower Eocene species exhibit a further approach toward the true *Sinopa* in one or another feature, but all are nearer to *S. rapax* than to the species here described. *S. major* of the Bridger (fig. 1*c*, 2*d*) is larger and more massive than *S. grangeri*, with lower crowned teeth, broad heels to the lower molars, etc.

#### SKULL, DESCRIPTION AND COMPARISONS.

The skull is elongate in both facial and cranial regions, with narrow muzzle, small brain case, moderately high sagittal and occipital crests, short and rather slender arches, strong postorbital constriction. The premaxillæ are deeply excavated for the reception of the lower canines, the borders of the excavation very strongly marked; their ascending processes are very slender and extend backward only to a point above  $P^1$ . The nasals are slightly expanded in front, and somewhat more

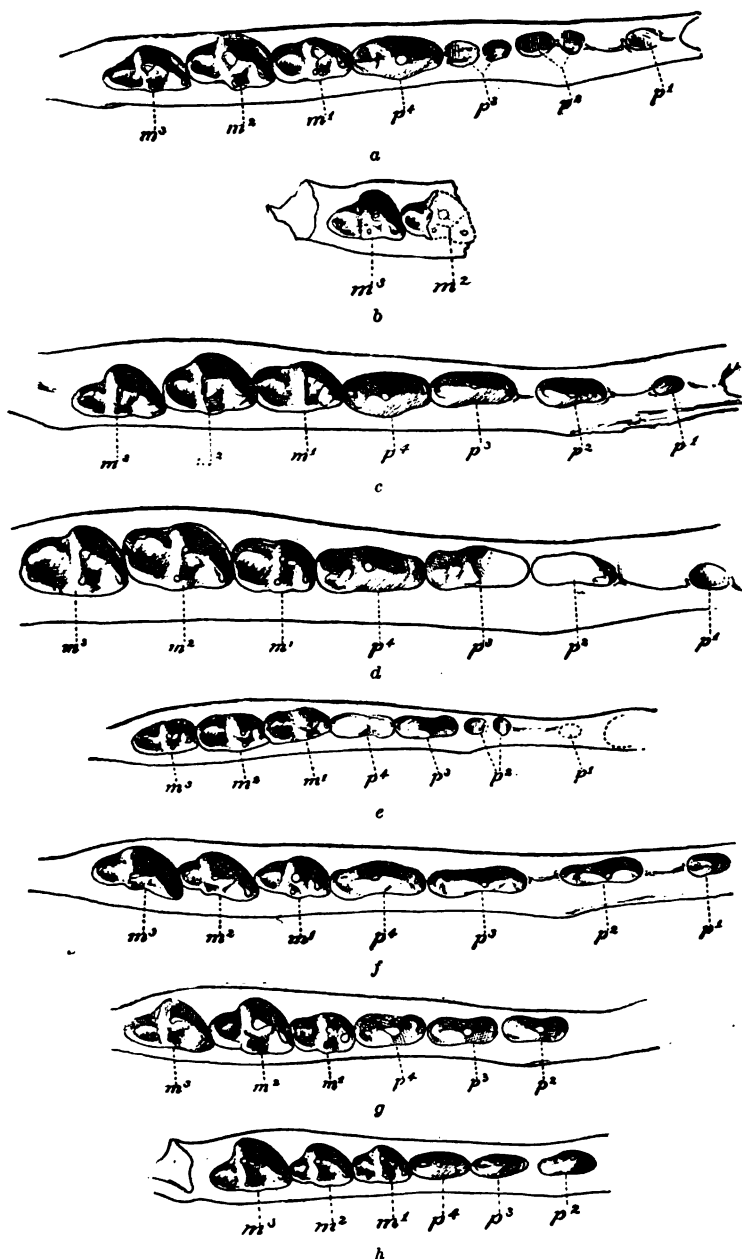


FIG. 2.—LOWER TEETH OF SPECIES OF SINOPA, TRITEMNODON, AND CYNOHYÆNODON. NAT. SIZE. CROWN VIEWS.

a, *Sinopa rapax* Leidy, Am. Mus. Coll., No. 11535. b, *Sinopa pungens* Cope. Type. Am. Mus. Coll., No. 5015. c, *Sinopa grangeri*, new species. Type. Cat. No. 5341 U.S.N.M. Coll. d, *Sinopa major* Wortman, Am. Mus. Coll., No. 11538. e, *Sinopa minor* Wortman, Am. Mus. Coll., No. 11532. f, *Tritemnodon agilis* Marsh, Am. Mus. Coll., No. 11543. g, *Tritemnodon whitæ* Cope, Am. Mus. Coll., No. 4781. h, *Cynohyænodon cayluzi* Filhol, Am. Mus. Coll., No. 11055.

expanded posteriorly, but to nothing like the extent seen in the Mesonychidæ or Marsupialia. The *lachrymals* have a broad semi-circular expansion upon the face, but the foramen is completely within the orbit. This condition appears to be generally characteristic of the Creodonta. In true Carnivora the lachrymal has a very slight expanse on the face, the maxillary coming nearly or quite to the margin of the orbit. In the carnivorous marsupials there is some expansion of the lachrymal upon the face, but in this group, as in the Insectivora, the lachrymal foramen is more or less external to the orbit. A much closer approach is seen among the Ungulata, where the lachrymal has a very large facial expansion, the foramen entirely intra-orbital, and the tubercle on the margin of the orbit. The form and extent of the facial part of the lachrymal approaches that in *Sinopa* most nearly in the primitive types—Oreodon, Dacrytherium, Agriochærus, Hyrachyus, etc. In the more elongate skulls of later Ungulates it becomes much more expanded.

The facial expansion of the lachrymal appears to be correlated with the position of the orbits, which in *Sinopa*, as generally among the Creodonta, are farther back than in modern Carnivora. In *Sinopa* they lie above  $M^{1-3}$ ; in *Canis* they are above  $P^4-M^2$ ; in *Viverra* above  $P^3-M^2$ ; in the opossum above  $M^{2-4}$ . In Ungulata they are above or behind the molars, and the extension of the lachrymal on the face varies in accordance.

The frontals are short, extending back on the top of the skull only to the posterior part of the temporal crests and forming no portion of the sagittal crest. At the sides they extend but slightly farther back, to the postorbital constriction, which is immediately behind the anterior end of the sagittal crest. They are broad anteriorly and inflated above the orbits, leaving a marked depression along the median line, deepest in front of the sagittal crest and shallowing out as it approaches the posterior margin of the nasals.

The parietals are remarkably long, extending well down on the sides of the skull and including the whole of the sagittal crest.

The premaxillaries are large, with wide ascending portions and moderately large infraorbital foramen situate above  $P^2$ ; the muzzle in front of this is compressed and deep; behind this point the skull expands rapidly as in *Daphænus* and the Canidæ generally.

The jugal is of moderate size and rather long; its anterior branch extends under the orbit and has a considerable contact on the face with the lachrymal, thus excluding the maxilla from any near approach to the orbit; the inferior branch is short, the posterior branch extends backward beneath the zygomatic process of the squamosal nearly to the glenoid fossa, ending in a slender splint, as among the Carnivora generally. In the opossum its posterior end is thickened and forms a considerable part of the anterior side of the glenoid fossa, while a

short process also extends backward above the zygomatic process of the squamosal.

The brain case is larger than in the opossum, but as in that animal the cerebral lobes were entirely contained within the parietals above, the frontals surrounding the olfactory lobes only. The elongate

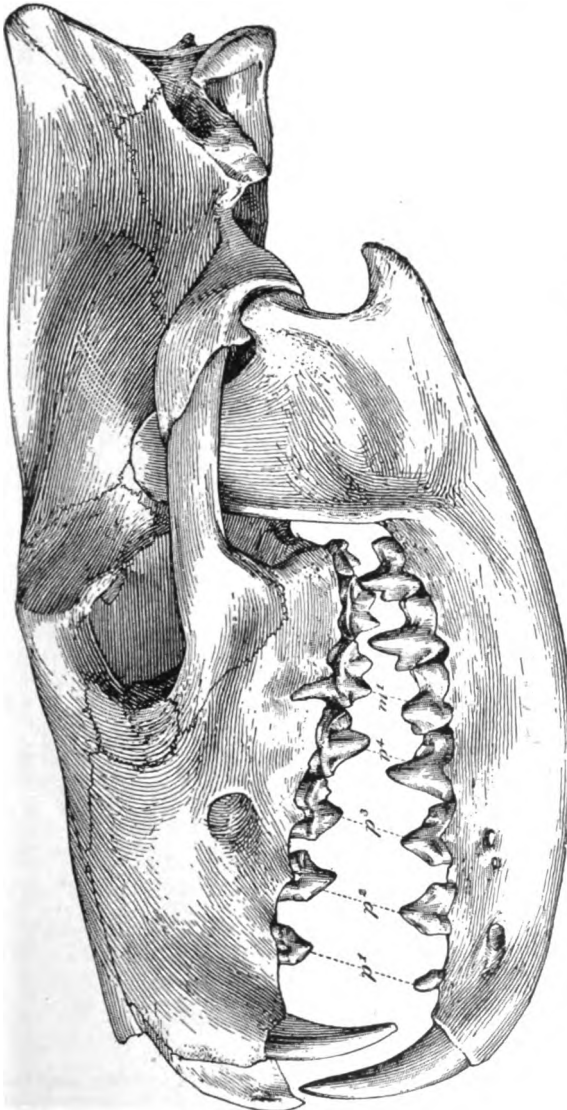


FIG. 3.—SINOPA GRANGERI, SIDE VIEW OF SKULL AND JAWS, NAT. SIZE.

cranial portion of the skull causes the arrangement of the cerebellar lobes to be entirely different from that of the opossum or of the insectivora, corresponding more with that in the Oligocene Carnivora. The cerebral lobes, however, are much smaller than in any of these.

The basicranial region is long, a feature eminently characteristic of

the Carnivora, and distinguishing them sharply from either marsupials or insectivores. In practically all modern carnivora the arrangement of the basicranial bones and foramina is obscured or modified by the

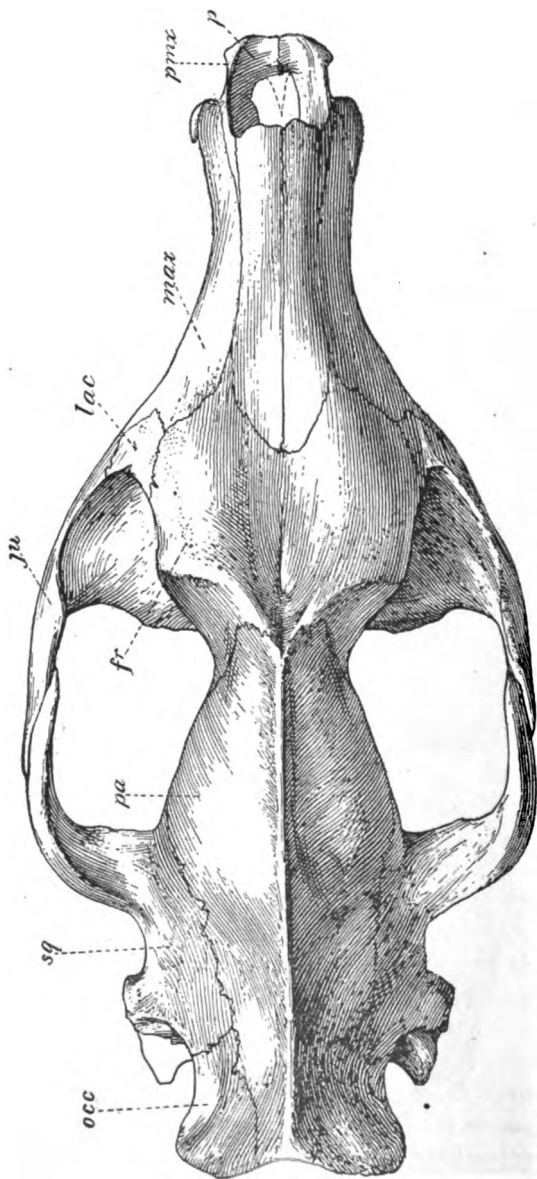


FIG. 4.—*SINOPA GRANGERI*, TOP VIEW OF SKULL, NAT. SIZE. *fr*, FRONTAL; *ju*, JUGAL; *lac*, LACHRYMAL; *max*, MAXILLA; *occ*, OCCIPITAL; *pa*, PARIETAL; *p* AND *pmx*, PREMAXILLARIES, AND *sq*, SQUAMOSAL BONES OF THE SKULL.

development of tympanic bullæ. In *Sinopa* the bullæ are absent, giving a singularly primitive appearance to this part; they were either not ossified at all or were loosely attached to the skull. The bullæ are not developed in marsupials nor in most Insectivora, but in both these

groups are frequently present false bullæ formed by processes of the alisphenoid, partially replacing the true tympanic bullæ. No sign of

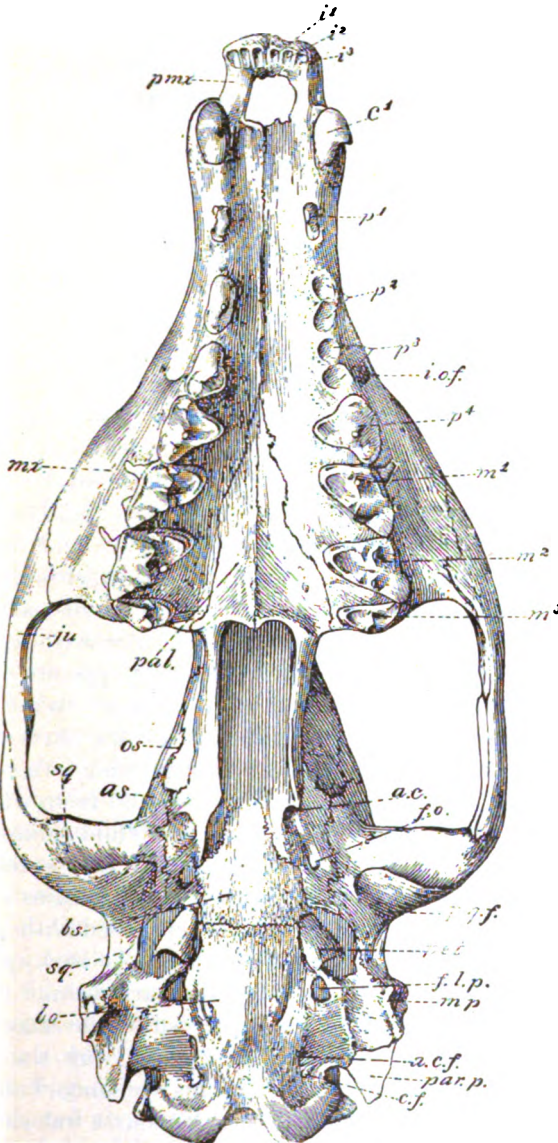


FIG. 5.—*SINOPA GRANGERI*, INFERIOR VIEW OF SKULL, NAT. SIZE. *g. c.*, ALISPHENOID CANAL; *a. c. f.*, SUPPOSED ANTERIOR CONDYLOID FORAMEN; *as*, ALISPHENOID (THE DOTTED LINE IS NOT CARRIED FAR ENOUGH); *bo*, BASIOCCIPITAL; *bs*, BASISPHENOID; *c*, CANINE; *c. f.*, CONDYLOID FORAMEN; *f. l. p.*, FORAMEN LACERUM POSTERIUS; *f. o.*, FORAMEN OVALE; *i 1, 2, 3*, INCISORS; *i. o. f.*, INFRA-ORBITAL FORAMEN; *ju*, JUGAL; *m 1, 2, 3*, TRUE MOLARS; *mp*, MASTOID PROCESS OF THE PERIOTIC; *mx*, MAXILLA; *os*, ORBITOSPHEOID; *p 1, 2, 3, 4*, PREMOLARS; *pal*, PALATINE; *par. p.*, PAROCCIPITAL PROCESS OF THE EXOCCIPITAL BONE; *pet*, PETROSAL PROMINENCE OF THE PERIOTIC BONE; *p. g. f.*, POSTGLENOID FORAMEN; *pmx*, PREMAXILLA; *sq*, SQUAMOSAL.

these processes is seen in *Sinopa*, and there is little or nothing in this important region of the skull to indicate either marsupial or insect

tivore affinities. On the other hand, if we compare it with the Oligocene dog *Daphænus*, in which only the smaller or true tympanic chamber of the skull was ossified, and this so loosely attached to the skull that it is rarely preserved, we find a very close correspondence indicative of real relationship, while the numerous and important points of difference from Insectivora and especially from marsupials indicate a remote origin of the divergence from these groups.

The basioccipital is long and broad. The broad flattened paroccipital processes arise considerably in advance of the condyles and project backward to a short point. In *Daphænus* the basioccipital is even longer; the paroccipitals have the same position and form, but curve downward at the tips. In *Didelphys* they arise almost opposite the condyles and project straight downward. In *Cynodictis* they project backward and are otherwise similar. In modern carnivora the tips usually extend farther downward and are soldered to the bulla. In *Erinaceus* and *Centetes* they have the more posterior position and project downward in the former, outward and backward in the latter. The condyloid foramen is situate considerably in advance of the condyles, as in carnivora generally. In marsupials and Insectivora it is close under the projecting border of the condyle, and in the former has an accessory foramen, also entering backward, close in front of it. In front of the condyloid foramen in *Sinopa* is a well-marked foramen entering forward, which Wortman homologizes with the accessory condyloid foramen of marsupials in spite of its opposite direction and quite different position in the bone. It appears to me much more probable that this foramen transmits one of the nerves or arteries which in later Carnivora pass through the jugular foramen (*for. lac. post.*), with which it corresponds in direction and from which it is not far removed. Indeed, in *Daphænus*, the condyloid foramen is a little farther forward and on the posterior border of the posterior lacerate foramen is a notch entirely corresponding to the remains of this accessory foramen, if, as I suppose, it has become fused with the lacerate. A similar notch is seen in *Hyaenodon*, where the backward displacement of the glenoid fossæ has crowded the parts behind them toward the condyle. The basisphenoid is not pierced by the carotid canal—an important distinction, as Wortman observes, from the marsupials; and he believes from indications seen on his specimen, but which I am unable to corroborate from this one, that its course was similar to that in true Carnivora, entering finally at the median lacerate foramen. The petrosal prominence is pear-shaped, the small end antero-internal; near the posterior end is the fenestra rotunda, exterior and a little in front of it the fenestra ovalis, and on the antero-exterior slope of the prominence a smaller foramen which I do not recognize. Outside of the petrosal prominence is a long, deep fossa bounded anteriorly by the alisphenoid, externally by the glenoid portion of the squamosal,

posteriorly by the mastoid portion of the periotic. At the bottom of this fossa lie the stylomastoid foramen and another foramen or deep fossa which I do not recognize. Behind the prominence lies the large oval posterior lacerate (jugular) foramen. The mastoid processes are of moderate size, short and stout, and extend, wing-like, outward and partly downward; posteriorly they are confluent with the bases of the paroccipitals. The postglenoid processes resemble the corresponding parts in *Daphænus*; the postglenoid foramen is of moderate size. The foramen ovale is rather large and is situate opposite the glenoid fossa, as in Carnivora; in Insectivora, and especially in marsupials, it is considerably in advance of it. The alisphenoid extends some distance behind the foramen ovale, wedged in between the basisphenoid and the glenoid portion of the squamosal, but it has no dependent process such as is seen in marsupials, and is especially developed in certain Insectivora. The posterior nares are not roofed over behind the molars, but the nareal canal is deep and broad, the pterygoid portions of the palatine and alisphenoid forming large dependent plates, as in Carnivora. The pterygoids proper are not preserved on this specimen. The pterygoid plates of the alisphenoid are variably developed in Insectivora, very slightly so in marsupials.

The palate is completely ossified. A number of minute (? nutritive) foramina on its surface are thought by Wortman to be an approach to the incompletely ossified palate of certain modern marsupials and some insectivores, but of this there seems to be no sufficient evidence. The posterior border of the palate is somewhat thickened, as in *Centetes* and *Myogale*, but has little resemblance to the posterior expansion and strong transverse crest seen in *Erinaceus* and *Didelphys*.

The occiput presents a very different appearance from that of the modern Canidæ and differs in much more essential respects from that of marsupials or Insectivora. The principal differences from the modern carnivore skull are apparently dependent upon the small development of the brain. The Oligocene Carnivora, and especially *Daphænus*, approach it much more closely. The early Ungulata also exhibit a considerable resemblance, but from Insectivora and marsupials it is separated by more radical features.

The exposure of the mastoid on the side of the skull is very small, scarcely extending above the mastoid process. The occipital surface is much contracted above the condyles, and above that flares out into a broad plate formed by the expanded occipital crests. These are continued downward and forward in strong lambdoid crests to the mastoid processes. Between the lambdoid crest and the condyle is a deep fossa bounded below by a strong crest connecting the outer ends of the condyle with the base of the paroccipital process. In *Daphænus* this deep fossa is largely filled up, presumably by expansion of the cerebellum from within; in *Canis* there is nothing left of it. In

*Canis* and other Carnivora there is a considerable lateral exposure of the mastoid; in *Canis* it faces partly backward. In the marsupials and in some Insectivora the exposure is entirely posterior, the squamosal (lambdoidal) crests continuing the occipital crest downward on each side and the mastoid exposure lying within them.

The lower jaw is unusually deep, with long loose symphysis extending back to a point beneath the anterior border of the third premolar. In the posterior portion it is quite like the long-jawed Carnivora in form, presenting none of the peculiarities of angle and coronoid seen in Insectivora, Chiroptera, and Marsupialia. The anterior and posterior mental foramina have the normal carnivore position, the former beneath the diastema between  $P_1$  and  $P_2$ , the latter beneath  $P_3$ . In certain Insectivora the posterior mental foramen is beneath  $M_1$ . This unusual character appears to be of importance in indicating relationship.

*Comparisons with Hyænodon.*—The dentition of *Hyænodon* is very

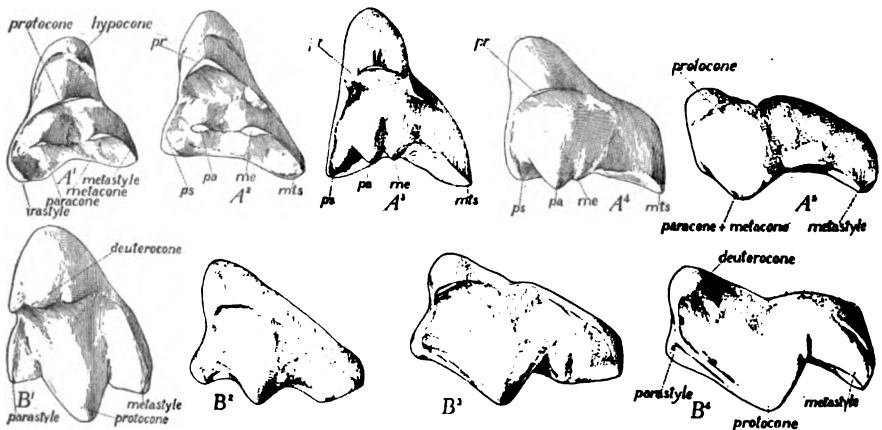


FIG. 6.—EVOLUTION OF THE UPPER CARNASSIAL IN CREODONTA AND CARNIVORA. SERIES A, HYÆNODONTIDÆ (SECOND MOLAR, RIGHT SIDE); A<sup>1</sup>, DELTATHERIUM; A<sup>2</sup>, SINOPA; A<sup>3</sup>, TRITEMNODON; A<sup>4</sup>, PTERODON; A<sup>5</sup>, HYÆNODON. SERIES B, CANIDÆ (FOURTH PREMOLAR, RIGHT SIDE); B<sup>1</sup>, PALÆONICTIS; B<sup>2</sup>, DIDYMICTIS; B<sup>3</sup>, DAPHGENUS; B<sup>4</sup>, CANIS. THE CARNASSIAL OF FELIS, NOT INCLUDED IN THIS SERIES, IS MUCH MORE LIKE THE HYÆNODON CARNASSIAL.

[Published in advance, by courtesy of Prof. H. F. Osborn, from his forthcoming memoir upon Trituberculy.]

clearly derivable from that of *Sinopa*, through *Pterodon* and *Tritemnodon*, as Scott and Wortman have pointed out in various publications. The accompanying figures, drawn from models made by the writer, illustrate these stages in the evolution of the specialized carnassial of *Hyænodon*. The changes correspond in upper and lower teeth, and are exactly analogous to the development of the carnassial in the true Carnivora. In the upper teeth the two series begin in teeth of widely different form and end in very similar teeth, furnishing one of the most striking examples known of true convergent adaptation, in that it results in the production of similar form from originally dissimilar

types, as distinguished from the far more common instances of parallel adaptation.

As has already been intimated, the geological occurrence of the known species forbids their being considered as in direct genetic sequence; but the genera may be properly so regarded (except *Deltaetherium*), and the features of skull and skeleton entirely accord with the teeth in indicating a direct genetic sequence of the genera.

The species of *Hyænodon* differ very considerably in certain adaptive features of the base of the skull, dependent upon the pushing backward of the glenoid articulation to a position almost opposite the occipital condyles. In all of them, and in *Pterodon* as well, the basioccipital is somewhat shorter than in *Sinopa* and the petrosal prominence of irregularly rounded form, situate at the bottom of a deep pit. The posterior nares are roofed over to a varying extent by union of the pterygoid plates of the palatines and alisphenoids. The tympanic bulla is ossified to a varying degree. The fossa between the condyles and lambdoidal crests is filled up as in *Daphænus*. The limbs show a more or less cursorial adaptation. These features are developed to the greatest extent in the large American species *H. horridus*; the European *H. brachyrhynchus* is the most primitive (except that the bulla is completely ossified according to Filhol's statement). A skeleton from Colorado referred to *H. cruentus* shows a mere ring of ossification of the tympanic, while in other species the bulla was complete but small (according to Scott). *H. paucidens* is the most primitive of the American species.

*Pterodon* is much like *Hyænodon* in the features of the base of the skull, but has the united mastoid and paroccipital processes extended into broad wing-like "jugular apophyses" (Filhol), while in *Hyænodon* they are less developed than in *Sinopa*. The fossa behind the lambdoids is deep, the post-nareal gutter narrowed anteriorly but not roofed over, and in other respects the skull is very primitive, but resembles the primitive species of *Hyænodon* and differs from *Sinopa* in the details of form of the bones and processes.

*Tritemnodon* is very close to *Sinopa* in all the details of skull and skeleton structure, as may be seen by comparison of the figures and description of *T. agilis* given by Wortman.

*Cynohyænodon* is near to *Sinopa* and *Tritemnodon*, but has a shorter basicranial region and larger brain case. It appears from Filhol's figures of *C. cayluxi* to show various other distinctions from these genera in the form of the otic region and arrangement of the foramina, as well as in the shorter, higher crowns of the premolars, all placing it more directly in the ancestral line of *Hyænodon* and *Pterodon*.

## VERTEBRAL COLUMN, DESCRIPTION AND COMPARISONS.

*Cervical vertebrae*.—The atlas is short with wide transverse processes, which are well expanded anteriorly, but not extended posteriorly as much as in most modern carnivora. The posterior opening of the vertebrarterial canal faces backward on the posterior margin of the transverse process, as in all carnivora except the Miocene and later dogs. The remaining features are

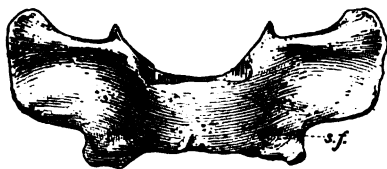


FIG. 7.—*SINOPA GRANGERI*, ATLAS VIEWED FROM ABOVE, NAT. SIZE. *s.f.* FORAMEN FOR EXIT OF 1ST SPINAL NERVE.

those usually found in Carnivora. It nearly resembles *Hyænodon* in proportions and form; in the cat the transverse processes have the same shape and position, but the body is a little longer; in *Canis* and *Daphenus* the transverse processes extend more posteriorly; in *Viverra* the body is considerably longer, the transverse processes more posterior and less expanded. In the opossum and hedgehog the form of the processes is different and the vertebral artery does not perforate the bone.

The axis is long, with high neural spine of the characteristic carnivore form, expanded into a broad plate extending forward as far as the tip of the odontoid and ending posteriorly in a stout backwardly directed spine. It is longer than in *Hyænodon* but somewhat shorter than in *Daphenus*, and shows no important distinctions from either.



FIG. 9.—*SINOPA GRANGERI*, SIXTH CERVICAL VERTEBRA, NAT. SIZE, SIDE VIEW. *aza.*, ANTERIOR ZYGAOPHYSIS; *il.*, INFERIOR LAMELLA OF THE TRANSVERSE PROCESS; *pza*, POSTERIOR ZYGAOPHYSIS; *s*, NEURAL SPINE, AND *sl.*, SUPERIOR LAMELLA.

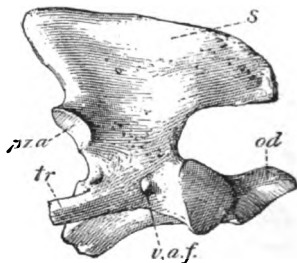


FIG. 8.—*SINOPA GRANGERI*, AXIS VERTEBRA, SIDE VIEW, NAT. SIZE. *od.*, ODONTOID PROCESS; *pza*, POSTERIOR ZYGAOPHYSIS; *s*, NEURAL SPINE; *tr*, TRANSVERSE PROCESS; *v. a. f.*, VERTEBRARTERIAL FORAMEN.

The remaining cervicals, except the seventh, have short spines, transverse processes with the inferior laminae expanded into broad plates, and superior laminae absent on the anterior ones, but moderately developed on the sixth. In the Carnivora the superior laminae are generally distinct upon the third to sixth vertebrae, successively increasing in size. In the opossum the arrangement is more as in *Sinopa*, except that the inferior laminae are less expanded. In *Daphenus* the upper laminae are developed upon the fourth, fifth, and sixth; in *Canis* upon fifth and sixth; in Felidae and Viverridae upon all four.

In the Machærodonts the superior lamina is not distinct upon any but the sixth, but the inferior lamina is less broad and plate-like.

The seventh cervical has a rather long spine, strong superior lamina, no inferior lamina, and is not perforated by the vertebrarterial canal. In this important feature, as well as in its general form, it agrees with the Carnivora and insectivores, and differs from marsupials.

The dorsal vertebræ number thirteen. The first ten have spines of moderate height, wider than in the dog or cat, higher than in *Viverra*, but not so wide. They decrease in height and increase in backward inclination to the tenth. Their transverse processes are rather large and stout, considerably expanded at the tips. The first is the most robust, the others of nearly equal size. The eleventh vertebra has no spine. Its anterior part and transverse processes resemble the anterior dorsals. Its posterior part resembles the dorsals and

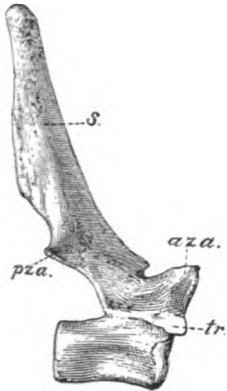


FIG. 10.—SINOPA GRANGERI, SECOND DORSAL VERTEBRA, SIDE VIEW, NAT. SIZE. *aza*., ANTERIOR ZYGAPOPHYSIS; *pza*., POSTERIOR ZYGAPOPHYSIS; *s*., NEURAL SPINE; *tr*., TRANSVERSE PROCESS.

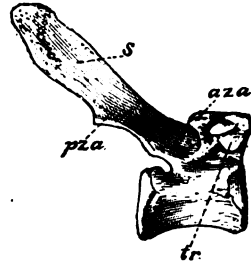


FIG. 11.—SINOPA GRANGERI, EIGHTH DORSAL VERTEBRA, SIDE VIEW, NAT. SIZE. *aza*., ANTERIOR ZYGAPOPHYSIS; *pza*., POSTERIOR ZYGAPOPHYSIS; *s*., NEURAL SPINE; *tr*., TRANSVERSE PROCESS.

lumbars behind it. The twelfth and thirteenth are like the lumbars and have short flat spines directed forward.

The lumbars are of large size; the centra long, except the seventh; the spines high and broad; the transverse processes long and directed forward, but not curved. The zyga-

pophyses are large and strongly convex, but not revolute. This type of lumbar characterizes all Creodonts (except that in *Patriofelis* the lumbar zygapophyses are revolute). Among modern Carniv-

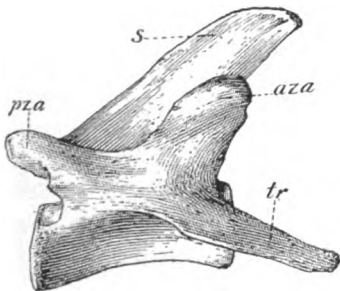


FIG. 12.—SINOPA GRANGERI, SIXTH LUMBAR VERTEBRA, SIDE VIEW, NAT. SIZE. *aza*., ANTERIOR ZYGAPOPHYSIS; *pza*., POSTERIOR ZYGAPOPHYSIS; *s*., NEURAL SPINE; *tr*., TRANSVERSE PROCESS.

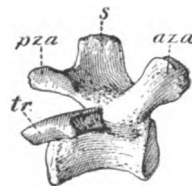


FIG. 13.—SINOPA GRANGERI, SECOND CAUDAL VERTEBRA, SIDE VIEW, NAT. SIZE. *aza*., ANTERIOR ZYGAPOPHYSIS; *pza*., POSTERIOR ZYGAPOPHYSIS; *s*., NEURAL SPINE; *tr*., TRANSVERSE PROCESS.

ora it is retained to the greatest degree among the Viverridæ.

The sacrum is composed of three vertebræ and is long and unusually large, especially the anterior sacral; the rib massive, expanded at its contact with the ilium. The posterior sacrals are not so large nor

their transverse plates so wide. The second sacral takes a minor part in the iliac articulation by means of the forward end of its transverse process.

The caudals are preserved in series as far back as the seventeenth. The first four have large, strongly convex zygapophyses like those of the lumbar, long, stout transverse processes, and rather short bodies. The fifth and sixth show the change to the middle caudal region, in which the zygapophyses are simplified, the arches reduced, the centra increased in length and diminished in width, the transverse processes shortened and expanded antero-posteriorly into flat plates as long as the centra, and decreasing in width on each successive vertebra until on the seventeenth they are reduced to ridges on the sides of the centra. The neural arches are complete as far back as the thirteenth vertebra.

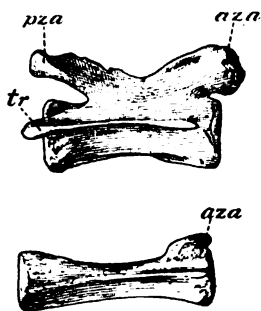


FIG. 14.—*SINOPE GRANGERI*, SEVENTH AND SIXTEENTH CAUDAL VERTEBRAE, SIDE VIEWS, NAT. SIZE. *aza*, ANTERIOR ZYGAPOPHYSES; *pza*, POSTERIOR ZYGAPOPHYSES; *tr*, TRANSVERSE PROCESS.

*Comparisons with Hyænodon.*—In the characters of the vertebral column *Sinopa* is nearer to *Daphænus* and *Cynodictis* than to *Hyænodon* or *Patriofelis*. It agrees with

the two former in the large long lumbar, the general character of the spines and transverse processes of most of the vertebrae, proportions of sacrum, proximal caudal spines, etc.

*Hyænodon* differs in the superior and inferior laminae of the transverse processes, distinct on cervicals 4-6; the lumbar smaller and shorter, their spines broader but not so high, their transverse processes much shorter, the sacrum much smaller, the tail much shorter, and lateral plates of middle caudals not prominent. All these features are probably due to adaptation to running, and are exactly paralleled in the distinctions between the modern Canidae and *Daphænus* or *Cynodictis*.

*Patriofelis* has shorter cervicals than *Sinopa*, lumbar large but short, their zygapophyses *revolute*, spines broader and wider at top, transverse processes short and stout. The sacrum is not so broad anteriorly, the caudals are massive, but not so long; the anterior ones have extremely broad, massive, transverse processes, while in the middle caudals the transverse lamellae are reduced to short, stout anterior and posterior processes. The neural arch continues only to the ninth vertebra, a remarkable feature considering the length and power of the tail.

*Oryæna* is proportioned much more like *Sinopa*, with similar type of dorsals, long and large lumbar, etc., but the skeleton is not complete enough to compare exactly.

*Hoplophoneus* has the transverse processes of the cervicals, including the atlas, greatly extended posteriorly. A distinct inferior lamina develops on C 5-6. The dorsals are not unlike *Sinopa*, but the posterior ones develop powerful anapophyses, which are continued into the lumbar with decreasing strength. The lumbar are not so long, their spines much like those in *Sinopa*, transverse processes considerably shorter. The sacrum is not so wide anteriorly, the spines higher. The transverse processes of the two first caudals are expanded into plates, in the next three they slant backward, and are not so stout as in *Sinopa*; the transverse lamellæ of the middle caudals are much less developed. The neural arches are continuous as far as the thirteenth caudal, but the middle caudals are smaller and the tail shorter.

#### RIBS AND STERNUM.

There are thirteen ribs. They are distinguished, especially the anterior ones, by exceptional shortness and rather broad, flattened shafts. The flattening of the shaft is more uniform from end to end than in dogs or viverrines, in which it is restricted to the distal middle section of a few ribs, and the others are much rounder and somewhat more slender and elongate. I do not find any Carnivora presenting the rib features of *Sinopa*. They do not appear to be marsupial characters, but are seen in early ungulates and (except the length) highly developed in the more recent ones.

Five sternal segments are preserved. All of them are of the narrow elongate type usually seen in Carnivora, and show none of the flattening observed by Wortman in *Mesonyx* and mentioned by him as a characteristic marsupial feature. It is also characteristic of most ungulates and of many other groups.

#### APPENDICULAR SKELETON, DESCRIPTION AND COMPARISONS.

*Forelimb.*—The limbs are remarkably small in comparison with the proportions of skull and backbone. They do not exceed those of a large domestic cat in length, although somewhat stouter, while the backbone (exclusive of the tail) is one-fourth longer than in that animal and the skull nearly twice as long.

The scapula is incomplete, the anterior border not being preserved on either side. Its general form, so far as comparison can be made, agrees best with *Canis*, being rather long and narrow for a carnivore, and the upper border at right angles to the posterior. The spine is about as high as in *Canis*, considerably lower and less overhanging than in *Felis* or *Viverra*. The acromion is much better developed than in *Canis*; apparently considerably more than in *Felis* or *Viverra*. Its tip is broken off, but it projects considerably beyond the glenoid cavity. The coracoid process is short but very distinct, as in *Felis*

and *Viverra*; in *Canis* it is absent. The last two features are seen in *Didelphys*, to which the scapula has otherwise little resemblance.

The humerus most nearly resembles that of the domestic cat, but is somewhat more massive throughout and a little broader at the distal end. The shaft is comparatively straight, the deltoid crest scarcely more prominent than in *Felis*, although extending farther down the shaft. The supinator crest is a little higher than in *Felis domestica*, the trochlea is considerably broader, and the internal condyle and

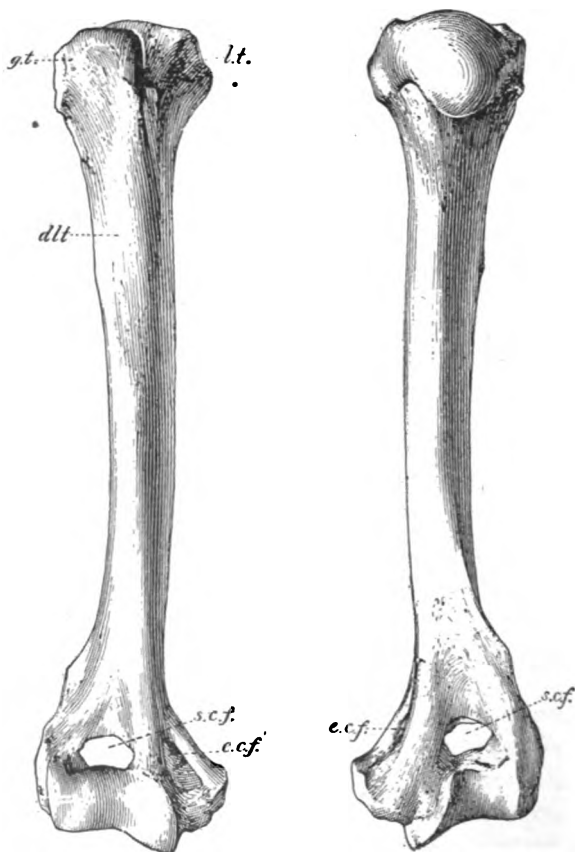


FIG. 15.—*SINOPE GRANGERI*, HUMERUS, ANTERIOR AND POSTERIOR VIEWS, NAT. SIZE. *g. t.*, GREATER TUBEROSITY; *dlt.*, DELTOID CREST; *e. c. f.*, ENTEPICONDYLAR FORAMEN; *l. t.*, LESSER TUBEROSITY; *s. c. f.*, SUPRA-TROCHLEAR VACUITY.

entepicondylar foramen considerably wider. There appears to be a supratrochlear foramen, but of this I can not be certain. The shaft is somewhat straighter, the deltoid crest less developed than in *Canis*. *Dapharnus* shows still more curvature of the shaft; the deltoid crest is higher and extends much farther down; the trochlea resembles that of *Sinopa*, but the internal condyle and the supinator ridge are less developed. The opossum humerus is widely different in form at the

distal end, the internal and external condyles almost equally developed, the trochlea very wide and shallow, the inferior end of the deltoid crest very high and situate far down on the shaft.

*Radius and ulna.*—The shafts of these bones are nearly straight, with the olecranon in line with the ulnar shaft, as in the viverrines. In the cats and in *Daphænus*, as also in the opossum, the shafts are slightly convex forward; in *Canis* they are considerably bowed. The olecranon is rather long, and expanded anteroposteriorly, as in *Daphænus* and the viverrines; in the cats it is a little shorter and projects more anteriorly; in the opossum it projects more anteriorly and is much less expanded in an anteroposterior direction. The ulnar and radial shafts are about equally robust, as in *Daphænus* and the viverrines; the ulna is somewhat larger proportionately than in either, but not so robust as in *Didelphys*, and is expanded on the antero-internal side, next the radius, in a broad flat plate, thin distally, but with thickened margin toward the proximal part. This plate lies in the position of the interosseous membrane, and probably gave a rigid attachment for strong pronator muscles. It is not present in other carnivora, which I have examined, nor in *Didelphys*. In *Hyænodon* it has become narrower and much thicker, forming an integral part of the very robust ulnar shaft, but it is clearly indicated by the broad deep groove extending down the anterior face of the shaft.

The distal end of the ulna resembles that of *Hyænodon* and the viverrines, and allowing for the great reduction in size in *Canis*, it resembles that genus, while it differs notably from *Daphænus* and the cats in the position of the cuneiform facet, which faces more distally (but not so much so as in *Hyænodon*), and is nearly continuous with the radial facet, while in *Daphænus* and the *Felidæ* it faces almost internally and stands on the end of a stout hooked process, separated by a deep groove from the radial facet.

The head of the radius has the same oval form as in *Hyænodon*, the ulnar facet being comparatively flat, permitting of but a limited

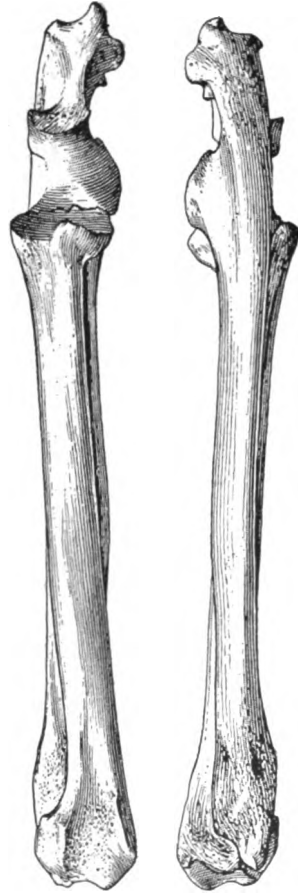


FIG. 16.—SINOPA GRANGERI, RADIUS AND ULNA, ANTERIOR AND POSTERIOR VIEWS, NAT. SIZE.

degree of rotation, much less than in *Daphænus* or *Felis*, about as in *Canis*. The coronoid process is less prominent than in *Ilyænodon*, much less than in *Daphænus* or *Felis*, somewhat more than in *Canis*.

The distal end of the radius likewise resembles *Ilyænodon* and differs widely from *Daphænus* and the Felidæ, much less from the Canidæ, in the convex posterior surface, the slight development of the styloid process (moderately strong in the dogs, remarkably strong in *Daphæ-*

*nus*) and many details of form and arrangement of the processes and tendinal grooves.

*Forefoot.*—The entire carpus except the trapezoid and trapezium, the greater part of three metacarpals, and most of the phalanges are preserved. The carpus has the usual creodont characters of separate scaphoid, lunar, and centrale, small magnum, large unciform and cuneiform, etc. The centrale is of moderate size, and lies principally under the scaphoid, but toward the dorsal surface projects considerably under the lunar so that its small exposure on the dorsal face of the carpus lies equally beneath scaphoid and lunar.

The carpus is higher than in *Ilyænodon*, but the bones have the same rather broad square character common to *Ilyænodonts*, *Oxyenids*,

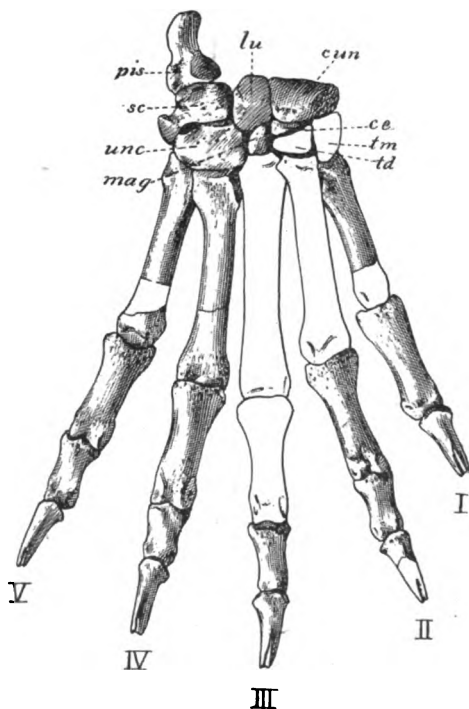


FIG. 17.—SINOPE GRANGERI FORE FOOT, NAT. SIZE, DORSAL VIEW. *ce*, CENTRALE; *cun*, SCAPHOID; *lu*, LUNAR; *mag*, MAGNUM; *pis*, PISIFORM; *sc*, CUNEIFORM; *td*, TRAPEZOID; *tm*, TRAPEZIUM; *unc*, UNCIFORM. THE DORSAL SURFACE OF THE MAGNUM IS REPRESENTED CONSIDERABLY TOO LARGE, AND THE PROXIMAL FACET OF THE LUNAR INCORRECTLY DEFINED SO THAT IT APPEARS TO EXTEND OVER THE WHOLE DORSAL SURFACE OF THE BONE.

and Mesonychids, which the writer has elsewhere explained as paralleling the ungulates.<sup>a</sup> The scaphoid is of moderate height and is principally supported by centrale and trapezium. The lunar is supported about equally by magnum and unciform. The cuneiform is

<sup>a</sup> Wortman, in criticising this passage, appears to have completely misunderstood my words, and supposed that by "podials" I meant claws! The parallelism with the ungulates does not of course involve relationship, but is due to a similar adaptation of the feet to use solely in locomotion. A later and less perfect parallelism in the podials is seen in the Canidæ, taking place after the consolidation of the scapho-lunar-centrale.

large, both broad and deep, lies mainly proximal to the unciform, nearly touches the lunar internally, and its ulnar facet faces chiefly proximal. The magnum, with very small dorsal surface, is much compressed laterally and strongly keeled on the proximal side toward the ventral surface. It carries no hook. The trapezoid is not preserved, but from the arrangement of the adjoining bones it appears to have been quite small, its height much less than in *Hyænodon*, with very slight contact with the magnum, a small dorsal-external contact with the scaphoid, and principally supporting the centrale. Its contact with the trapezium appears to have been lateral-superior. The trapezium is not preserved, but from other specimens it is known to have been rather large, not as high as in *Hyænodon*, and permitting a greater divergence and more freedom of motion of the pollex, which can hardly, however, be said to be even semi-opposable.

The metacarpals are five in number, all being of approximately equal robustness, but the laterals reduced in length, although much longer than in *Hyænodon*. The exact proportions can not be determined from this specimen, but apparently they were the same as in the manus of *Tritemnodon*. The fifth digit is restored somewhat too long in the drawing. In *Sinopa* and *Tritemnodon*, as in *Hyænodon*, the symmetry of the manus is pentadactyl with a tendency to tridactylism more marked in the oligocene genus. In the true Carnivora, and in the Mesonychidæ among Creodonts, the manus is constructed upon a tetradactyl symmetry.

The phalanges are not remarkable. The unguals are small, more compressed than in *Hyænodon*, and fissured at the tips.

The manus of *Tritemnodon* agrees in all its principal features with that of *Sinopa*, but differs in numerous small details of structure, the greater part of which are slight approximations toward the *Hyænodon* manus.

*Hind limb.*—The pelvis has the same proportions between pre- and post-acetabular regions as in *Hyænodon*, about the same as in the cat. The superior border of the ilium is considerably expanded, a remarkable character which finds its nearest analogue in the Phenacodontidæ, although seen to a less extent in *Hyænodon* and *Hoplophoneus*. In the modern Carnivora it is the inferior border of the ilium (below the primitive rod, and below the sacral articulation) which is expanded to a greater or less degree. The ischium is rather thin and slender and the pubis stout, as compared with modern Carnivora.

The femur is of moderate length, having about the same proportions as in *Hyænodon*. The upper part of the shaft has a considerable lateral curvature. The third trochanter is much better developed than in *Hyænodon*, and placed considerably lower down on the shaft than in *Daphneus* or *Hoplophoneus*. In modern Carnivora the third tro-

chanter is absent and the shaft much straighter. In the *Condylarthra* it is much stronger and situate about the middle of the shaft, except in *Euprotogonia*, in which it is higher up. The distal end of the bone has a moderate lateral expansion and great vertical depth, as in *Hyænodon* and the *Condylarthra*, the rotular trochlea narrow and elongate, but not extending so far up on the anterior surface of the shaft

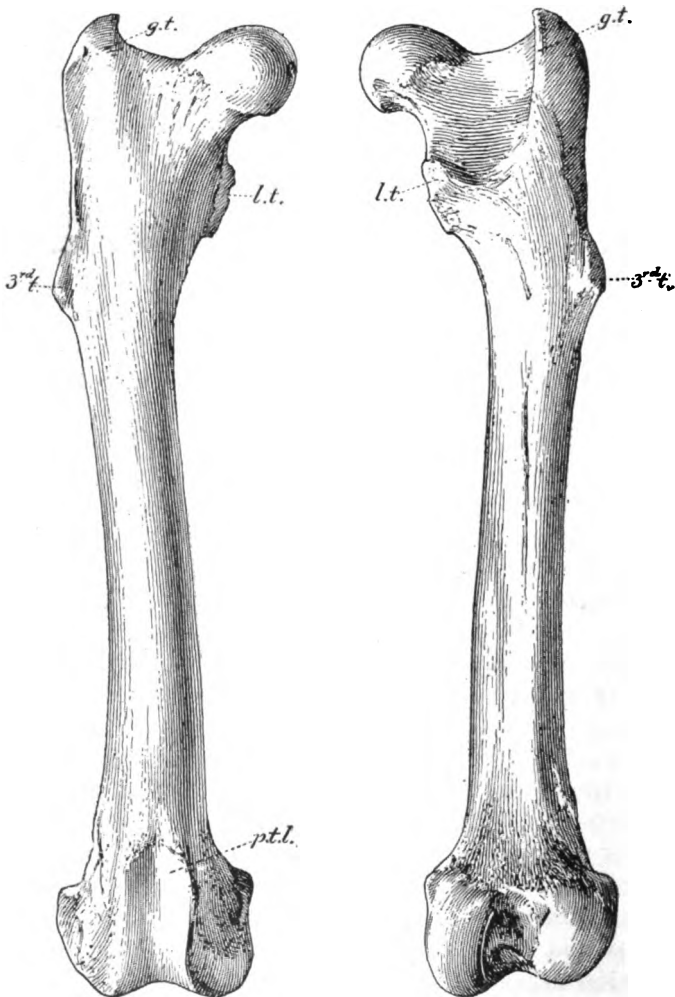


FIG. 18.—*SINOPA GRANGERI*, FEMUR, ANTERIOR AND POSTERIOR VIEWS, NAT. SIZE. *g. t.*, GREATER TROCHANTER; *l. t.*, LESSER TROCHANTER; *3rd t.*, THIRD TROCHANTER; *p. t. l.*, ROTULAR TROCHLEA OR GROOVE FOR THE PATELLA.

as in *Hyænodon*. In *Patriofelis* the femur has a much more massive shaft, the distal end is not so deep, the third trochanter is somewhat similar in development, and the curvature of the shaft about the same. *Oryæna* has a weaker third trochanter, thicker shaft, and distal end more like the normal *Carnivora* type.

*Tibia and fibula.*—The proportion of these two bones is about as in *Hyænodon*, the fibular shaft less reduced than in modern carnivora, among which the viverrines offer the nearest approach, while *Daphænus* is decidedly nearer. The bones are proportionately shorter, with less rounded shafts than in the more modernized carnivora, e. g., *Canis* or *Felis*. The most marked peculiarity is the well-developed fibulo-calcaneal facet, which is only a little less extensive than in *Hyænodon*.

*Hind foot.*—The pes is pentadactyle, and its symmetry is approximately mesaxonic, but less exactly so than in the manus, the first digit being shorter and more slender than the fifth, and the second somewhat shorter, although stouter, than the fourth, while the third projects beyond either, and is nearly, but not quite, symmetrical at its distal end. This symmetry agrees entirely with that of *Hyænodon* and differs radically from the paraxonic symmetry of manus and pes in the true Carnivora and the Mesonychidæ. In the Oxyænidæ the foot symmetry appears to be approximately as in the Hyænodontidæ, but the foot is broader and shorter, especially in *Patriofelis*, and the symmetry less noticeable in consequence.

The astragalus differs considerably from that of *Hyænodon*. The trochlea is not nearly so deep, the posterior tendinal groove is much deeper, the neck is longer, the head much broader, not nearly so deep, more convex laterally. The astragalar foramen is distinct, but very small, and I can not be certain that it is continuous through the bone.

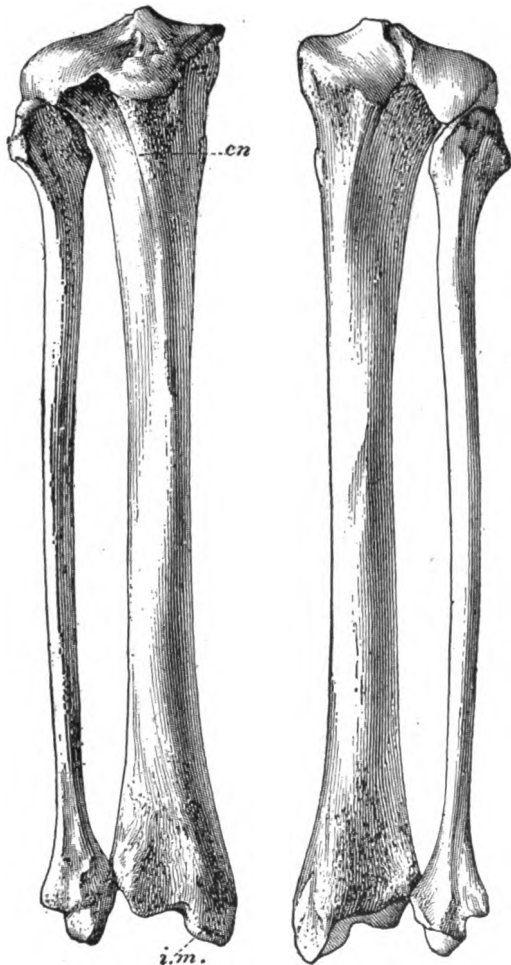


FIG. 19.—SINOPA GRANGERI, TIBIA AND FIBULA, NAT. SIZE, ANTERIOR AND POSTERIOR VIEWS. *cn*, CNEMIAL CREST ON ANTERIOR SURFACE OF TIBIA; *i. m.*, INTERNAL MALLEOLUS OF TIBIA.

The calcaneum has a considerably longer tuber than in *Hyænodon*, somewhat grooved on the superior surface of its distal end for the tendon of the plantaris, as in many modern carnivora. In *Hyænodon* the groove is absent. The cuboid is longer than in *Hyænodon* and

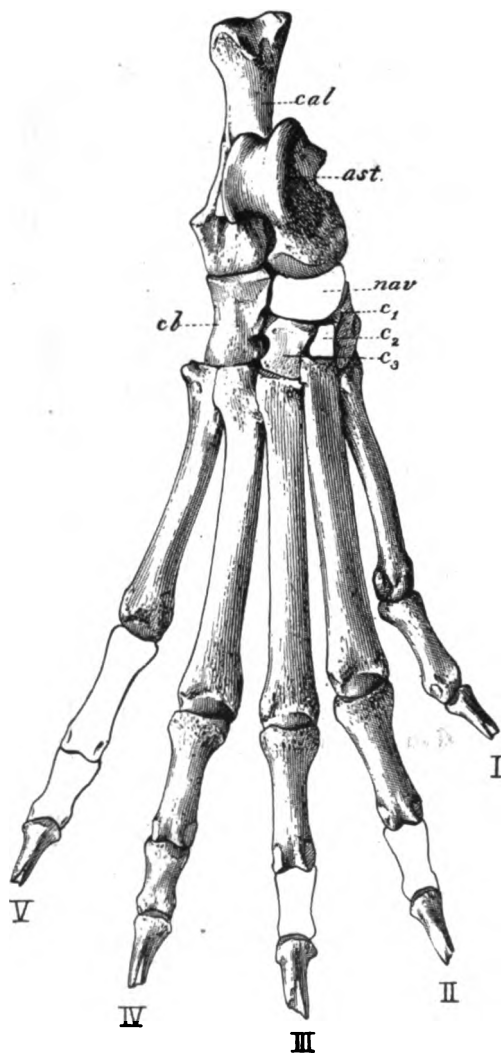


FIG. 20.—*SINOPA GRANGERI*, HIND FOOT, NAT. SIZE, DORSAL VIEW. *ast*, ASTRAGALUS; *cal*, CALCANEUM; *cb*, CUBOID; *c*<sub>1, 2, 3</sub>, CUNEIFORM BONES; *nav*, NAVICULAR.

has a considerable astragalar facet, which does not extend, however, to the dorsal surface. In *Hyænodon* this facet is smaller and farther removed from the dorsal surface of the bone. It seems to have been absent or indistinct in the specimens examined by Professor Scott. In the Oxyænidæ and Mesonychidæ it is much better developed. In modern carnivora it is absent, but it is moderately developed in *Daphnus*, although lateral instead of partly superior, as in Creodonta. The cuneiform bones are much as in *Hyænodon*; except that the entocuneiform is shorter and broader, its contact with Mt. II less, and the distal facet broader and more oblique. It is less elongate and very much broader than in modern Carnivora, and the distal facet retains much more of the primitive saddle-shaped curvature, thus permitting a greater degree of opposition of the first digit.

The metatarsals are somewhat less compressed and more slender than in *Hyænodon*; their relative proportions are noted above. The head of Mt. I is broader. In other respects there is very little difference. The phalanges resemble those of the forefoot, except in their larger size and some-

what more elongate proportions. The pes is by no means as long or compressed as in most modern Carnivora, and this, with the difference in symmetry, involves numerous small differences in construction and arrangement of the bones.

*Tritemnodon* closely resembles *Sinopa* in the structure of the hind limb, as shown by comparison of Doctor Wortman's description of the parts known to him and of the more complete specimens in the American Museum collections.

*Comparisons of the appendicular skeleton.*—In the characters of the fore and hind limb, *Sinopa* is in the main of the primitive creodont type, but shows an earlier stage of the cursorial adaptations of *Hyænodon*, and shares with that genus a number of peculiarities probably characteristic of the family. The long, narrow scapula, the expanded ilium, the depth of the distal end of the femur, the reduction of the deltoid and supinator ridges of the humerus, the squaring of the carpus and deepening of the astragalar trochlea and head, and in general the elongation of the limb bones, elongation and compression of the feet, are all differentiations from the primitive type, carried to but a slight extent in *Sinopa*, to a considerably greater extent in *Hyænodon*, paralleled in all the cursorial Carnivora and in the Condylarthra, and carried to a much greater extent in the cursorial Ungulata. On the other hand, the retention of the coracoid process and long acromion of the scapula, the comparatively long post-acetabular region of the pelvis, the entepicondylar foramen on the humerus and the third trochanter on the femur, the stout ulna with its long olecranon, the unreduced fibula, the distinct centrale, the astragulo-cuboidal articulation, the large size of the lateral digits, and the moderately compressed claws, are apparently primitive creodont features not yet modified by the cursorial adaptation which had begun to show itself in the appendicular skeleton. Some of these characters are still retained by *Hyænodon*, and they are retained to a varying extent by the other creodont families and by the more primitive modern Carnivora. The mesaxonic manus and pes, the fibulo-calcaneal articulation, and the broad flange on the radial side of the ulnar shaft, are apparently family characters of the Hyænodontidæ. The first and the last characters are also seen in the Phenacodontidæ, and the relative conditions of the appendicular skeleton in *Sinopa* and *Hyænodon* are exactly paralleled by the relative conditions in *Euprotogonia* and *Phenacodus*.

#### ANALYSIS OF THE CHARACTERS OF SKULL AND SKELETON.

*Primitive mammalian features.*—Skull elongate, brain-case small, sagittal and occipital crests strong, orbits situate above molars, hence lachrymal and superior process of jugal moderately expanded upon

the face. Nasals somewhat expanded posteriorly. Tympanic bullæ not ossified. Teeth 44 in number, the molars tritubercular above, tuberculo-sectorial below, the premolars trenchant. Ribs short, sternum narrow, tail long and powerful, limbs rather short, flexible, feet pentadactyl, pollex and hallux divergent, centrale present, astragalus with shallow trochlea and round convex head; fibula little reduced, and ulna as stout as radius. Coracoid process on scapula.

*Primitive eutherian features.*—Dentition  $\frac{3.1.4.3}{3.1.4.3}$ . Angle of jaw not inflected. Sacrum of 3 vertebræ. No vertebrarterial foramen on seventh cervical.

*Primitive carnivore features.*—Incisors small, canines large, piercing. Parietal bones long, basicranial region long, mastoid exposure small, lateral. Posterior nareal canal long and deep. No false (alisphenoid) bulla. Dorsolumbar formula twenty. Lumbar very large and long, their zygapophyses large and very convex. Ungual phalanges bearing moderately compressed claws. A small contact between astragalus and cuboid. A third trochanter rather high up on shaft of femur.

*Cursorial adaptations.*—Limb bones elongate. Scapula long and narrow. Humerus with reduced deltoid and supinator crests. Ulna and radius with limited amount of pronation and supination. Carpus broad, its proximal articulations transverse. Ilium expanded, distal end of femur deep, astragalar trochlea somewhat excavated and extended posteriorly, and head somewhat deepened. Fore and hind feet somewhat compressed and apparently digitigrade.

*Special hyænodont characters.*—Molars developing a shear by extension of parastyle, especially on M  $\frac{3}{4}$ . Manus and pes mesaxonic. A fibulo-calcaneal facet. Astragalo-cuboid facet reduced. Claws fissured (also in Mesonychidæ and Oxyænidæ).

*Generic and specific characters.*—These need not be repeated here, as they have been fully defined in an earlier section of this paper.

#### RELATIONSHIPS OF SINOPA.

The primitive mammalian features are predominant, as might be expected in a Middle Eocene animal. These features are found in all early mammals, whether Metatherians or Eutherians. *Sinopa* is, however, a typical Eutherian in the dentition, in the conformation of the angle of the jaw, and other characters of less importance. The primitive carnivore features are numerous and important, and amply demonstrate the pertinence of *Sinopa* to this order. The characters of the base and back of the skull especially distinguish it sharply from either marsupials or Insectivora. The cursorial adaptations in the limbs and feet are comparatively slight, but unmistakable. Along with the special hyænodont characters they demonstrate the position of the genus as a primitive member of the Hyænodontidæ. It stands directly ancestral to *Hyænodon* in all details of its structure and shows

a considerable degree of progress from the primitive carnivore type toward the line which terminated in the large, highly specialized Hyænodons of the American oligocene. As has already been observed, the geological occurrence of the species of this phylogenetic line makes it improbable that *Hyænodon* was directly descended from any of the Middle Eocene species of *Sinopa*; it is more probably derived from a Lower Eocene or earlier species. Wortman has suggested *S. opisthotoma* as a possible ancestor, but this species does not entirely meet the required conditions.

The relationship to the carnivorous marsupials appears to be a remote one, despite a considerable degree of superficial resemblance, due chiefly to the retention of the primitive mammalian characters. In all marsupials the angle of the lower jaw is inflected, the molars number four, the premolars not more than three, the basicranial region is short and the mastoid exposure posterior and of large size, the carotid canal pierces the basisphenoid, the pterygoid processes of the alisphenoid and palatine are little developed, and more or less of a false bulla is formed; the dorsolumbar formula is 19, and there are numerous less important details of form and structure in the bones, showing that they are far removed from *Sinopa* or from any of the Creodonta. The dorsolumbar formula of *Mesonyx*, according to Wortman, was 19, as in the marsupials, and this genus also has a broad posterior expansion of the nasals; but in the much more important characters of the base and back of the skull, as in all other features of the skeleton, it is evidently of true carnivore affinities, somewhat disguised by a high degree of specialization in certain parts. In *Sinopa*, in *Oxyæna* and *Hyænodon*, and probably in *Patriofelis*, the only other creodonts in which the dorsolumbar formula is known, it is twenty, as in all Carnivora, and these genera have all evidently descended from primitive carnivore ancestors, whose principal distinctions are given above.

The Insectivora appear to be in many respects intermediate between Carnivora and marsupials, but how far they are actually so would be difficult to say. It is clear that the Creodonts are not nearly related to any living Insectivora, but we know so little about the past history of the insectivore group that we can not yet say whether it is really a homogeneous one or an arbitrary association of unrelated types. In the features of the base and back of the skull they differ very considerably from Carnivora and agree more or less with marsupials (the course of the carotid canal differs from either group). They have the Eutherian dental formula, a non-inflected angle of peculiar type in the lower jaw, etc.; these features characterize the most primitive and ancient known types as well as the modern ones.

The position and relationships of the Eocene Carnivora have been variously estimated by the different writers who have studied and described their remains. The incomplete specimens first found in the

Old and New Worlds were referred to the true Carnivora (Fissipedia); later on the great French palæontologists, Gervais and Gaudry, emphasized the affinities of some among them to the marsupials, a view adopted in a broad sense by Huxley and other authorities, but disputed by Filhol and most subsequent writers. In 1875 the accumulating new discoveries of material enabled Cope to reconstruct, from various forms referred to marsupials, Carnivora, and Insectivora, the group of *Creodonta*, with affinities to all three orders named, but more nearly related to the two latter, and containing the ancestral types of the modern Carnivora. Schlosser, in his monumental studies upon the fossil primates and ungulates of Europe, regards the *Creodonta* as definitively related to the true Carnivora, excluding from the group a number of insectivore-like types which had been included by Cope. He divides them into *Adaptiva* and *Inadaptiva*, both springing from a common primitive creodont stem, the former approximately ancestral to the true Carnivora, the latter becoming extinct. This view is substantially indorsed by subsequent writers, with the exception of Wortman, who in his studies of Eocene Carnivora in the Marsh collection, appears inclined to lay emphasis, especially in the first part of his paper, upon the marsupial affinities of the group.

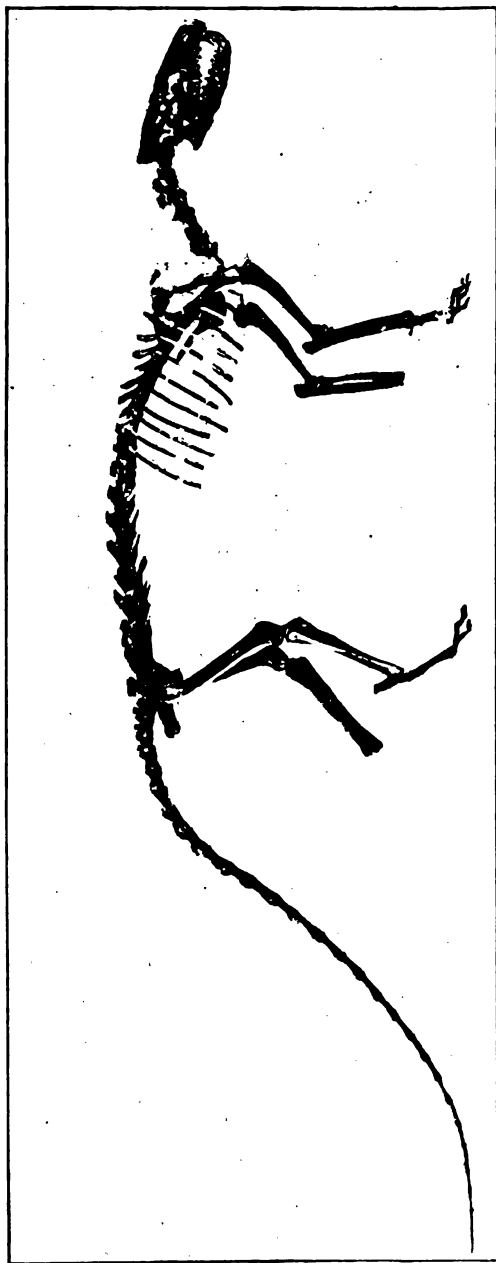
So far as I can understand Doctor Wortman's position, it seems to be that the creodonts and carnivores are two distinct branches, both derived from the Cretaceous marsupials exemplified by *Didelphops*, and that the modern carnivorous marsupials, except for the inflection of the jaw and suppression of the second set of teeth, are little altered from the Cretaceous ancestors of the placental Carnivora. Hence the Basal Eocene creodonts and carnivores are closely allied to the living marsupials, the Middle Eocene less nearly so, and in the Oligocene and later formations the modern carnivore stamp becomes more apparent.

The essential divergence of this view from that generally accepted is in the nearer alliance implied between marsupials and placentals. In Wortman's view the Carnivora, *Creodonta*, *Insectivora*, etc., arise each as a separate branch from the Cretaceous marsupials, which also persist little altered in the modern Polyprotodonts. If this be true, the modern groups of placentals are not more nearly related to each other than they are to the Polyprotodont marsupials, and their resemblances are all due to parallelism. This view is only held conjecturally in the case of other groups, but is quite specifically stated in regard to *Creodonts* and true *Carnivores*.

I do not think, however, that the evidence, even as stated by Wortman, supports this view, and quite naturally he is inclined to lay emphasis upon the marsupialoid features of the creodont skull. On the contrary, I think it is safe to say that if we set aside super-

ficial and adaptive characters, and rest principally upon deep-seated resemblances such as are found in the characters of the base of the skull, the dental and dorsolumbar formulæ, etc., we find every known creodont very much nearer to the modern Carnivora than to the modern marsupials. On the other hand, the little that is known of Cretaceous marsupials bears distinctly the marsupial stamp in every detail and does not show any essential approach to the early placentals.





SINOPA GRANGERI, TYPE SKELETON, MOUNTED IN A WALKING POSITION.

The end of the tail, right fibula, parts of ribs, scapulae, and forefoot, and various processes and spines of vertebrae, etc., have been restored in plaster, indicated on the specimen by a lighter color. No attempt has been made to restore the left manus and pes. (Found by Walter Granger in the Lower Bridger beds on Smith's Fork, east of Fort Bridger, Wyoming.)



# THE LOCUSTIDÆ AND GRYLLIDÆ (KATYDIDS AND CRICKETS) COLLECTED BY W. T. FOSTER IN PARAGUAY.

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By ANDREW NELSON CAUDELL,  
*Custodian, Section of Orthoptera.*

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The Locustidæ contained in the Foster collection number 176 specimens, representing 28 species, while the Gryllidæ comprise 69 specimens, representing 11 species. The following paper treats of these two families. The nonsaltatorial forms have previously been reported upon,<sup>a</sup> and the Acrididæ will soon be discussed in the pages of these Proceedings by Professor Bruner.

## Family LOCUSTIDÆ.

### Subfamily PHANEROPTERINÆ.

#### 1. ISOPHYA HAMATA Giglio-Tos.

Fourteen males, sixteen females, three nymphs. January, February, March, August, and November.

These specimens agree almost perfectly with the description.

#### 2. ANIARA PROXIMA Bruner.

Seven males, three females. February and October.

The males are somewhat larger than the measurements given by Bruner. The anterior tibiae bear two or three distinct spines on the upper outer carina, thus differing from the generic diagnosis, but the radial veins are connate and the transverse veins are parallel, thus referring the species to the genus *Aniara*. The cerci of the male are simple, not furnished with a median process, as in the species of the genus *Hyperophora*, but are long and slender. While these insects possess several characters at variance with those described for *A. proxima*, they are nevertheless questionably referred to that species. They may eventually prove to be quite distinct, generically as well as specifically, but I have not thought it best to so consider them at this time.

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<sup>a</sup>Journ. N. Y. Ent. Soc., XII (1904), pp. 179-188.

### 3. *HYPEROPHORA BRASILIENSIS* Brunner.

Three males, three females. January to March.

The ovipositors of these females are longer than described by Brunner, one being 12 mm. long and nearly straight.

### 4. *HYPEROPHORA MINOR* Brunner.

Eleven males, six females. January, February, March, May, October, and November.

The females have the following measurements:

Length, pronotum, 3.75 mm.; elytra, 25–27 mm.; hind femora, 21–22 mm.; ovipositor, 7–8 mm.

### 5. *HYPEROPHORA PERUVIANA* Brunner.

Three males, five females, and one female nymph. August to March.

The females have the following measurements:

Length, pronotum, 4–4.5 mm.; elytra, 29–31 mm.; posterior femora, 23–25 mm.; ovipositor, 5 mm.

### 6. *AMAURA OLIVACEA* Brunner.

Three females. February and March.

The anterior tibia really has a terminal spine and sometimes also a basal one, but they are seemingly very readily broken off, being absent in most specimens. The posterior femora of these specimens measure 18 mm. in length and the elytra 23–25 mm. by 3–4 mm. broad at the middle.

### 7. *HOMATOICHA FUSCOPUNCTATA*, new species.

Seemingly allied to *Ceraia punctata* but can not be placed in *Ceraia* because of the armature of the posterior femora, as described below.

Color, green with the elytra marked along the median area with a row of seven or eight small fuscous spots. Lateral lobes of the pronotum higher than long, the postero-ventral margin nearly straight. Posterior femora long and nearly unarmed beneath, the single specimen before me having a single spine on the inner carina just before the middle on the right leg, while the left femora is wholly unarmed. Ovipositor strongly curved upwards, apically rounded and finely serrate, the serrations extending back well toward the base above.

Length, pronotum, 5.5 mm.; elytra, 31 mm.; posterior femora, 26 mm.; ovipositor, 5 mm.

*Type*.—A single female, without date, in the collection of Professor Brunner.

8. *CERAIA SIMILIS*, new species.

Near *C. dentata* Brunner and falls next to it in the table of species. The cerci of the male are about four times as long as the basal width, apically depressed and armed with a sharp incurved black tooth and furnished on the inner side beyond the middle with a thick projection; subgenital plate of male elongate, tapering, apically cleft and furnished with styles as long as the middle width of the plate; subgenital plate of female considerably produced, tapering, the narrow tip subtruncate, very slightly notched; ovipositor strongly upcurved, the tip rounded, finely serrate near the apex below and above for the greater part of its length.

Length, pronotum, male and female 5-5.5 mm.; elytra, male 30-31 mm., female 30-32 mm.; posterior femora, male 21 mm., female 22 mm.; ovipositor, 7 mm.

*Type*.—Cat. No. 9626, U.S.N.M.

Five males, seven females. February, March, and April.

9. *CERAIA CORNUTOIDES*, new species.

Allied to *C. cornuta* Brunner and falls next to it in the table of species. The lobes of the anal segment of the male, however, are but one-sixth as long as the pronotum instead of being longer, as described in *cornuta*. The tarsi are scarcely infuscated and the cerci of the male are blunt and apically forked, each fork apically pointed. The ovipositor is long and apically rounded. The antennæ are basally annulated with black, and the subgenital plate of the male is as described in *cornuta*. One female has the antennæ unicolorous, the black bands being obliterated. It may represent another species.

Length, pronotum, male and female 6 mm.; elytra, male 34 mm., female 38-39 mm.; posterior femora, male 27 mm., female 27-30 mm.; ovipositor, 11 mm.

*Type*.—Cat. No. 9627, U.S.N.M.

One male, three females. December, January, and February.

10. *SCAPHURA VIGORSII* Kirby.

One female. January.

This is probably the same species as that mentioned by Gigliotto from Paraguay but is a little larger than the measurements given by Brunner. The anterior tibiæ are armed above with three spines and the middle ones with several on both margins. Thus it is an aberrant member of this genus as defined by Brunner.

## 11. PHYLLOPTERA ALLIEDEA, new species.

Green, in dried specimens the head and pronotum usually somewhat yellowish. Pronotum flat above, the disk not much broader posteriorly than anteriorly; lateral carinæ sharp; lateral lobes vertical, higher than long, broadly rounded below; meso- and metasternal lobes triangular. Elytra without markings, except two or three small obscure spots on the ulnar vein, and about 5 mm. shorter than the wings. Legs green or yellowish green; anterior tibiæ sulcate above but unarmed; femora sparsely spinose below, the posterior ones armed on both margins in the apical half; spines of the anterior and intermediate femora usually very small and inconspicuous, generally confined to one carina. Cerci of the male curved inward and upward, the tip truncate and subdentate; subgenital plate of the male of moderate length, apically truncate, ventrally bisulcate, furnished with styles as long as the apical width of the plate. Ovipositor one and one-half times as long as the pronotum, apically pointed, serrate above on the apical half.

Length, pronotum, male and female, 5 mm.; elytra, male 33–34 mm.; female 35 mm.; posterior femora, male 19–21 mm.; female 22 mm.; ovipositor, 8 mm.; width of elytra at the middle, male 12.5–13 mm., female 14 mm.

*Type*.—Cat. No. 9628, U.S.N.M.

Six males, one female. February.

This species is allied to *P. finoti* of Griffin and also somewhat allied to some of the species described by Giglio-Tos, but seems distinct from any of them. It probably resembles *P. phyllopteroides* Burmeister more closely than any other species, but is separable from that insect, as characterized by Brunner, by several characters.

## 12. PHYLLOPTERA FOSTERI, new species.

*Female*.—Uniformly brownish testaceous with the elytra marked along the middle with three small fuscous spots. Anterior tibiæ unarmed above and smooth; anterior and intermediate femora unarmed or the anterior ones with a few very short inconspicuous spines on the anterior side. Lateral lobes of the pronotum higher than long, the anterior margin slightly sinuate; lateral carinæ sharp. Elytra but a little more than one and one-half times as long as the posterior femora, but not so short as in *brevifolia*.

Length, pronotum, 5 mm.; elytra, 34 mm.; posterior femora, 22 mm.; ovipositor, 7 mm.; width of the elytra at the middle point, 13.5 mm.

*Type*.—One female, without date, in the collection of Professor Bruner.

This species is seemingly allied to *brevifolia* Brunner and *oralifolia* Burmeister and in a table of species would fall between those species.

### 13. *PHYLLOPTERA SPINULOSA* Brunner.

Three males and four females. January, February, and March.

Two of the male specimens have a round yellowish spot near the center of the elytra. It was not determined if this is of specific value, as no female with this marking is in the collection. The anterior tibiae are dorsally somewhat sulcate in these specimens.

### 14. *PLAGIOPTERA BICORDATA* Serville.

One female. January.

### 15. *TURPILIA SUBINERMIS*, new species.

Size, small. Differing from the described species of the genus in having the posterior femora unarmed below, or nearly so, and with the anterior and intermediate tibiae spined above with several spines.

Color, green or yellowish green. Pronotum with the lateral lobes scarcely higher than long, meeting the disk with a rounded angle. Elytra elongate, apically narrowly rounded, in the female but little shorter than the wings, in the male considerably shorter. Legs slender; anterior tibiae rounded above and armed on the outer margin with 3 spines; middle tibiae sulcate above and armed on the inner margin with several spines and on the outer carina with 1 or 2; anterior and intermediate femora armed below with 3 or 4 small spines; posterior femora usually unarmed below, sometimes with a few very small spinules. Cerci of the male about five times as long as the basal width and apically bent abruptly inward, the tip truncate; subgenital plate apically truncate with moderately long, stout, rigid styles. Ovipositor about as long as the pronotum, strongly upcurved at the base, finely serrate above and below in the outer three-fourths.

Length, pronotum, male, 4-4.25 mm.; female, 4.5 mm.; elytra, male and female, 22-25 mm.; posterior femora, male, 16-16.5 mm., female, 17-18 mm.; ovipositor, 5-5.5 mm.; width of the elytra at the middle, male and female, 6.5-7.25 mm.

*Type*.—Cat. No. 9632 U.S.N.M.

Two males and four females. December and February.

This species exhibits some characters at variance with those attributed to *Turpilia*, but I have hesitated to make a new genus for it. The spines of the anterior and intermediate tibiae are very fine and are often absent, probably broken off.

### 16. *STEIRODON VALIDUM* Stål.

One female. December.

This specimen is a little smaller than the measurements given for this species by Brunner, the size being as follows:

Length, pronotum, 14.5 mm.; elytra, 73 mm.; posterior femora, 34 mm.; ovipositor, 8 mm. Width of the elytra at the middle, 26 mm.

## Subfamily PSEUDOPHYLLINÆ.

17. *DASYSCELUS NORMALIS* Brunner.

Very similar to *D. argentina*<sup>a</sup> of Berg, but a little larger. The color and general structure seems very like Berg's species, but I can scarcely agree with Brethes in considering these synonymous.<sup>b</sup> They differ specifically in the following respects: The posterior femora of *normalis*, as represented by the specimens before me, are much longer and the anterior femora are armed beneath on the inner side with three distinct spines, while in *argentina* they are described as unarmed. The ovipositor is considerably broader than in *argentina* and the legs are very little mottled and the antennæ scarcely at all banded. The measurements of the specimens before me are as follows:

Length, pronotum, male 8 mm., female 9 mm.; elytra, male 9.5 mm., female 10–10.5 mm.; anterior femora, male 10 mm.; female 10.5–11 mm.; intermediate femora, male 7.5 mm., female 8–8.5 mm.; posterior femora, male 17 mm., female 20.5 mm.; posterior tibiæ, male 18 mm., female 20 mm.; ovipositor, 12 mm.; width, posterior femora, male 3.5 mm., female 4 mm.; ovipositor, 3.25 mm.

One male and two females. December and January.

## Subfamily GRYLLACRINÆ.

18. *HYPERBÆNUS BOHLSII* Giglio-Tos.

One male. February.

## Subfamily CONOCEPHALINÆ.

19. *COPIOPHORA PRODUCTA* Bolivar.

One female. February.

The pronotum is a little short and the ovipositor a little long for this species, measuring, respectively, 9 and 38 mm. in length.

20. *CAULOPSIS OBERTHURI* Bolivar.

One male. August.

The pronotum of this specimen shows no indication of anterior emargination.

21. *CONOCEPHALUS DISSIMILIS* Serville.

Three males, four females, two nymphs. December, January. February, and March.

<sup>a</sup> This species, which was described under the genus *Pleminia*, is in part the species questionably referred to *Pleminia miserabilis* by Giglio-Tos in Bull. Mus. Torino, IX, no. 184, 1894, p. 40, and later referred by the same author to the *Dasyscelus demigratus* of Brunner. But that species is typically African and will probably be found to differ from this South American form.

<sup>b</sup> Anal. Mus. Nac. Buenos Aires, (III) V, 1905, p. 67.

## 22. CONOCEPHALUS PUSTULATUS Redtenbacher.

One female. December.

## XIPHELIMUM, new genus.

*Male*.—Robust. Fastigium narrow, narrower than the basal segment of the antennæ, which it does not surpass, dorsally very narrowly sulcate, separated from the face below by a constriction and transverse sulcus; face smooth. Pronotum smooth, subtruncate before and behind, the disk posteriorly considerably elevated and moderately produced; lateral lobes rectangulate below, the posterior border nearly straight, humeral sinus slight, anterior border perpendicular in upper half, the lower half tapering backward, meeting the posterior margin at right angles; lateral carinæ barely indicated by broadly rounded angles; prosternum bispinose; meso- and metasternal lobes acute angulate but not spinose. Wings and elytra of equal length, surpassing the short abdomen, but scarcely passing beyond the middle of the long hind femora; elytra very broad, inclosing the abdomen and broadly rounded or subtruncate apically, the costal area very broad, transparent and occupied by very distinct parallel transverse veins; stridulating organ well developed. Legs slender, anterior and intermediate tibiæ with 6 subequal spines on each side below, the posterior tibiæ with an apical spine on each side above; anterior and intermediate femora unarmed, the posterior ones armed below on both margins; genicular lobes spinose. Cerci cylindrical, slightly incurved and armed on the inner side beyond the middle with a broad double-pointed tooth.

*Type*.—*Xiphelimum amplipenne*, new species.

This genus is allied to both *Xiphidium* and *Orchelimum*, the more heavy form giving it more the appearance of the latter. The very broad elytra with the transparent costal field with its array of distinct parallel transverse veins gives it a very characteristic appearance.

## 23. XIPHELIMUM AMPLIPENNIS, new species.

*Male* (female unknown).—General color greenish, the top of the head and of the pronotum anterior of the fairly distinct principal sulcus with a broad mesial band of solid black, rarely extending faintly back upon the posterior part of the disk. Elytra with the apex externally longitudinally folded, giving the tip a notched or truncate appearance when viewed from the side or end. Legs reddish, the apices of the posterior tibiæ and femora piceous and the posterior tarsi also black. The posterior legs are very long and the femora are armed on each side below with 5 or 6 stout spines.

Length, pronotum 4-4.5 mm; elytra, 10-11 mm; posterior femora, 14-16.5 mm.

*Type*.—Cat. No. 2630, U.S.N.M.

Five males. February and March.

24. **XIPHIDIUM BRACHYPTERUS** Redtenbacher.

Two females. January and February.

25. **XIPHIDIUM LONGIPES** Redtenbacher.

Two males, one female. February and March.

26. **XIPHIDIUM MERIDIONALE** Scudder.

Six males, twelve females. January, February, and August.

27. **XIPHIDIUM SALTATOR** Saussure.

Two males, four females. January and February.

This is probably but a form of *fasciatum*, having been referred to as such by Griffini. Most of these females have the ovipositor 12 or 13 mm. long, but one specimen has it barely 9 mm. This latter specimen, which agrees with ones named *saltator* by Dr. S. H. Scudder, has the ovipositor straight while in the others it is a little curved.

28. **XIPHIDIUM STRICTOIDES**, new species.

*Female* (male unknown).—Superficially resembling *X. strictum* Scudder and in many respects structurally allied to it.

Slender. Green or brownish. Fastigium of the vertex narrow, viewed from above narrower than the basal segment of the antennæ, constricted before the tip, from an anterior view considerably and gradually narrowing from above downward. In the allied species, *strictum*, the vertex is much broader, being as broad as the basal segment of the antennæ when viewed from above, and when viewed from in front narrows abruptly from above downward, appearing triangular. Pronotum with the lateral lobes rounded-angulate below, the posterior margin straight, without sinus. Dorsum of head and pronotum usually unicolorous, sometimes with the median line infuscated. Legs unicolorous, all the femora unarmed; anterior tibiæ with 6 small spines on each side below. Wings aborted; elytra about as long as the thorax, apically narrowly rounded, not, or barely, overlapping. Abdomen unicolorous. Ovipositor very long, much longer than the posterior femora, nearly straight.

Length, pronotum, 3.25-3.5 mm.; posterior femora, 15.5 mm.; elytra, 3-3.5 mm.; ovipositor, 24 mm.

*Type*.—Cat. No. 9631, U.S.N.M.

Four females, one immature. December, January, and February.

Family GRYLLIDÆ.

29. *SCAPTERISCUS BORELLII* Giglio-Tos.

Four specimens. November and February.

30. *SCAPTERISCUS CAMERONI* Giglio-Tos.

Two specimens. March.

31. *GRYLLUS ARGENTINUS* Saussure.

One male and two females of the long winged form and one brachypterous male. November, December, and January. Also one nymph taken in August.

32. *GRYLLUS ASSIMILIS* Fabricius.

Four males, nine females, long winged; one male, three females, short winged. Also a number of immature specimens. December, January, and August.

33. *MIOGRYLLUS PUSILLUS* Burmeister.

One male, one female. January and February.

34. *NEMOBIUS FASCIATUS* DeGeer.

Two males. February.

35. *NEMOBIUS MELLEUS* Scudder.

Two females. February.

36. *CYRTOXIPHUS*, species.

One small nymph, probably belonging to this genus. January.

37. *DIATRYPA TUBERCULATA* Saussure.

One female. January.

This small elongate yellowish cricket is very probably correctly referred here. It has the following measurements:

Length, pronotum, 2.5 mm.; elytra, 10 mm.; posterior femora, 7.5 mm.; ovipositor, 6.5 mm.; width of pronotum, 2.75 mm.

The disk of the pronotum is longitudinally striped on each side with fuscous.

38. *ENEOPTERUS SURINAMENSIS* DeGeer.

Seven males, nine females. February, March, July, August, and October.

39. *COPHUS THORACICUS*? Saussure.

One female. October.

It is doubtful if this specimen belongs to this species, though it certainly belongs to the genus. The type locality, Cuba, is far from Paraguay, and there are also discordant characters in the structure of the insect. The color is dark brown mottled with black, the front and middle legs are distinctly ringed with black, and the hind femora are mottled with fuscous. The posterior tibiæ have four spines on each side.

Length, pronotum, 5 mm.; anterior femora, 10 mm.; posterior femora, 20.5 mm.; ovipositor, 20 mm.

## BRAINS AND BRAIN PRESERVATIVES.

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By ALEŠ HRDLÍČKA,

*Assistant Curator, Division of Physical Anthropology.*

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### PART I.

#### PHYSICAL CHANGES IN HUMAN AND OTHER BRAINS COLLECTED UNDER DIFFERENT CONDITIONS AND PRESERVED IN VARIOUS FORMALIN PREPARATIONS.

Anatomical and anthropological investigations on the brain to determine the homologies and differences in the organ and all its parts, between man and other animals, and between races and other groups of mankind, make large collections of brains necessary. Such collections imply the use of means by which the brains can be kept indefinitely in good condition for study. An ideal means would be one which would allow every specimen to preserve its form, size, weight, and all macroscopical as well as minute features. The need for such an agent has long been felt and led from dry preparations to the use of various liquid preservatives, among which, subsequently to the introduction of that chemical in 1894 by Blum, have been solutions containing formaldehyde.

The commercial solutions of formaldehyde, known ordinarily as formol, or formalin, have, even when much diluted, the quality of rapidly penetrating and hardening brain tissue, allowing but little alteration in the form of the organ and preserving much of its color. Furthermore, when hardened, specimens can be kept in the formalin solution without further noticeable change quite indefinitely and the preservative is not expensive. The chemical, however, is not wholly without objections; some persons are affected adversely by its fumes, the volume and weight of the brain are increased somewhat in its solutions, and it does not serve best the purposes of histology; yet the other advantages of formalin are so great that, until something more efficient be discovered, it can not well be dispensed with for brain preservation.

Efforts have been made to correct the faults of formalin by the addition of other substances to its solutions, or by following these, after the desired hardening of the brain had been effected, with other preservatives. It has been combined with or followed by various proportions of alcohol (Parker & Floyd, Marie, Gerota, etc.), potassium bichromate, or Müller's fluid (Diedrichs, G. Retzius), glycerin (Lanzillotti-Buonsanti, Chencinski), sodium acetate with sodium chloride and alcohol (Stroud, Wilder), sodium chloride and zinc chloride (Fisk), sodium chloride alone (Spitzka), and bichloride of mercury.<sup>a</sup> All of these combinations have been reported upon favorably. The effects of several formalin solutions have been observed<sup>b</sup> with some detail, but of no single solution do we possess exact and sufficiently detailed data as to its action on the brain, especially physically, and its action on the brains of persons of different ages, or on those of different animals, or finally on those collected under widely different conditions of the organ, or of temperature. Yet it is important to be acquainted with such facts. It is desirable to know which really is the best solution or combination for at least most of the specimens, so that such a preparation alone may be used. Such knowledge would tend to bring about not only a much-desired unity of procedure, but also a general understanding, at any stage, of the state of our material, so far as formalin preservation is concerned. The use of a single solution with well-known effects would regulate our records and methods, and allow of a degree of accuracy in weight determinations and measurements not now possible.

With these facts in mind, and remembering the excellent work by Donaldson in 1894 on the physical changes in the brain produced by various preservatives in use before the introduction of formalin, the writer, in establishing a brain collection in the Department of Anthropology of the United States National Museum, has endeavored to make a series of tests with several solutions, the main component of which was Merck's formalin.

The material accruing to the brain collection of the Museum is heterogeneous, ranging from man's brains<sup>c</sup> to those of the lowest mammals,<sup>d</sup> and from aged individuals to embryos, hence it was particularly suitable for experiments. Besides this it is always possible

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<sup>a</sup> Still other compositions were employed for the purposes of histology and pathology—see summary in Tellyesnitzki. Special methods, also, having no bearing on the theme of this paper, were devised for the preservation of the natural color of various organs.

<sup>b</sup> See Dexler, p. 382, after Flatau; records of the weight of the brain in 1 per cent. 5 per cent, and 10 per cent formalin solutions in 1, 3, 30, 90, 150, and 450 days.

<sup>c</sup> Of these, unfortunately, not a sufficient number were received in good condition during the progress of the experiments.

<sup>d</sup> The term "mammal" is used, for want of a better term, throughout this paper as a designation for other mammals than man.

in a city to obtain in fresh condition large numbers of heads of slaughtered animals. Utilizing both resources, a double plan was followed. A number of different formalin solutions was made up, some in concentrations used by other workers and a few empirically as to strength, and each solution was used on a series of brains as they were received, including specimens of every nature. The second procedure was to obtain a large number of brains, as far as possible in the same condition, from some one fair-sized animal, and to subject uniform series of such brains to the action of different solutions. The results of this latter inquiry appear in the second part of this paper.

There are numerous factors which, as Donaldson has already shown, affect the changes in the brain in the same solution. One of these is the degree of freshness of the brain; another is the temperature of the air (large differences); and still another is the presence or absence of the soft membranes. Only the last of these conditions was capable of being fully regulated in the National Museum collection. The subjects from which brains are here obtained come from different sources, and it is impossible to get all the brains equally fresh; and as to cold and heat, the collecting continues throughout the year, and the laboratories are not so fitted as to keep up an even temperature. Yet no specimens were included in the tests that were sufficiently advanced in decomposition to make their hardening and preservation doubtful; and the changes of temperature in the laboratory where the brain collection is stored would not exceed 40° F. as the maximum in the course of the year. The brain was always laid into the preservative with the soft membranes intact or but slightly injured.

The regular procedure in cases of the first category was as follows: The brain, being extracted without the dura mater, was immediately weighed; the solution in which it was to be laid was prepared beforehand; a layer of absorbent cotton was placed on the bottom of the glass jar to be used, and a quantity of the preservative poured in; the brain was then placed into the solution, with its base downward on the cotton, so as to rest easily (the cerebellum and cerebrum in the larger brains being separated by a thin layer of cotton), and a sufficient quantity of the preservative was added to rise 1 to 1½ inches above the specimen. The jar was then closed, labeled, and placed on a shelf, where it remained for one week. No injection through the arteries or into the ventricles was practiced, because it would have been impossible with all the specimens, and it was not found essential. On the eighth day the brain was taken out, drained in a fixed manner, and then weighed; the old cotton and solution were replaced with new, in same quantity, the brain was put back into the jar and placed again on the shelf. One month after receiving the specimen the same procedure was repeated. Other weighings were taken in some cases, during as

well as after the first month, with always the same method of drainage, but without a change of solution.

• The method of draining steadily adhered to and applicable to specimens of all sizes, is to take the brain carefully into one or both hands, and then swing the arms with a somewhat rapid motion from fore backward, by which most of the liquid attached to the brain is thrown off; this takes only a brief time, after which the brain is placed for five minutes upon a dry cotton towel. This procedure gives a good and fairly uniform drainage, and is preferable to the use of funnels.

In the second category of cases one of several additional procedures introduced was proportioning the quantity of the preservative, in cubic centimeters, to the weight of brains, in grams.

The solutions chosen for the specimens here dealt with were 3 per cent, 5 per cent, 10 per cent, and 15 per cent formalin (commercial solution of formaldehyde) in distilled water; two solutions of formalin, 5 per cent, to which was added salt, in one case enough to raise the specific gravity to 1,035,<sup>a</sup> and in the other to 1,030; and in addition the writer used several combinations of formalin with solutions of ordinary alum (potassium and aluminium sulphate), which was chosen for its astringent effects on organic tissues. In two series a saturated solution of alum<sup>b</sup> was mixed with one part of water, and in another with two parts of water.

The changes to which most attention was paid, and which probably represent best the physical changes, were, as with Donaldson, and Flatau, those of weight. The general and specific results follow:

The changes in the weight of brains in all the mixtures showed (1) *a characteristic type for every solution*, and (2) *a noticeable variation for every solution*.

(1) In every solution the first three to five days were with all brains the period of the most rapid changes in weight. In probably all of the solutions here reported upon, and with all brains, there was an initial stage of gain. This reached more or less promptly its maximum, and was followed by a general, long-continuing loss. A period of stability was established but slowly. So far as the observations went (two years), absolute stability in weight of the specimens was not reached. In every solution the daily changes in the brain weight formed a characteristic curve. This will be better illustrated in Part II.

In all the simple solutions of formalin in water, up to 15 per cent of the former (the strongest tested), the initial gain was well marked. It was larger with the weakest solution and decreased as the propor-

<sup>a</sup> Near the specific gravity of the whole brain; after Spitzka.

<sup>b</sup> A saturated solution of alum was prepared by placing an excess of that salt in a large jar of water, stirring well, allowing the mixture to stand at ordinary temperature for several days, and filtering just before using.

tion of formalin increased, which showed that the effect of formalin on the brain was to hinder its enlargement (apparently due to water alone) and probably, in addition, to promote the loss of some of the constituents of the organ. After the culmination of the process of gain, which, as shown by further experiments, was always completed before nine days, a gradual progressive loss followed, which in percentage was alike with the different solutions. The ultimate weight of the brain depends, in consequence of this similarity of loss, very largely on the height of the initial rise in weight. If this had been large, as with the 3 per cent solution, the ultimate weight (within two years) would still be above the original; but if the gain was smaller, as with the 15 per cent formalin solution, the ultimate weight of the specimen would be found more or less below its weight immediately after extraction from the skull.

Whenever a marked increase in the weight of the brain took place, there was also a noticeable increase in its volume.

The effect of adding alum or salt to formalin solutions was to decrease or, with larger quantities, almost entirely to do away with the initial gain, and to augment the subsequent absolute loss of brain weight. The percentage of the loss in weight, however, remained related to that in the simple formalin solutions. Simultaneously with the loss of weight in the stronger concentrations was also visible a decrease in the volume of the organ. No direct relation was found between these phenomena and the specific gravity of the solutions. It appears that alum, sodium chloride, and, according to more recent experiences, other salts also, as well as alcohol, act on the brain physically much like greater proportions of formaldehyde; hence the use of such means with formalin permits the obtaining of similar physical results with correspondingly smaller proportions of this chemical.

A renewal of the preservative generally affected slightly the changes in the brain, causing a temporary rise in weight.

As to the rapidity of hardening and other visible changes in the brain, the differences between the several liquids were not great. A moderate toughening of the brain was in every one of the preservatives observable on the second day, and a good hardening, with fresh adult specimens, was generally reached within a week. In the salt-formalin solution the brains were, at least for a time, slightly softer, in the alum-formalin solution slightly more resistant, than those preserved in simple solutions of formalin of the same strength. A higher percentage of formalin was favorable to a more rapid and perhaps a slightly greater hardening. On the whole, should one be given specimens of the same size, but each hardened in a different solution of those here dealt with, after they had lain a few months in the liquid, it would be quite impossible by the hardening alone, as perceptible through the unaided touch, to distinguish any of the preparations.

The hardening of small mammal and bird brains was effected much like that of the larger specimens. In hardening foetal human brains, the best results were obtained by the aid of stronger alum solutions.

The color of the brain (except so far as it may be due to hemoglobin, which is bleached) was affected but little by any of the solutions employed. Sodium chloride produced a lighter color or bleaching of the tissues; alum a slightly grayish tinge of the surface. Alum was more effective than salt in showing the differentiation of the gray and white matter.

(2) With all the care exercised, the ratio of change in any given series in which the same preservative had been used was not uniform. A large portion of the irregularity must be attributed to the physical status, and some probably to the chemical condition of the organ. When the two halves of any brain were treated in the same preservative, the results were always much alike.

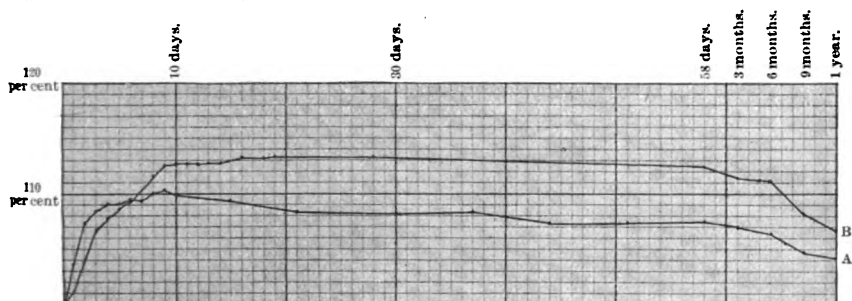
The physical condition of the brain includes its size and the quantity of blood or other liquids it may contain. The size of the brain has been found in general to have a pronounced influence upon the weight and volume changes in the organ. The larger the brain, the smaller the per gram changes, and the opposite. While there are individual exceptions, the cases conforming to the rule (see detail tables) are too numerous to leave any doubt on this point. What the causes of this phenomenon are is not yet clear, though presumably the larger brains have a firmer structure—that is, could better resist absorption<sup>a</sup>—and the very small brains are of necessity preserved in relatively much larger quantities of fluid, which may aid solution. It is possible that it is mainly if not entirely the size which accounts for the differences between the changes in three principal series of brains—those of human beings, of mammals, and of birds—but this needs further experimentation before a final decision can be obtained.

The degree of brain congestion must be a factor affecting the brain changes, but not enough specimens came to hand to throw much light on this point. Theoretically, a congested brain ought to gain less and lose more than a normal one, in any preservative. Higher degrees of congestion, not uncommon in human specimens, are rare in other larger mammals and are practically never met with in the smaller animals.

Besides the differences in the changes of various brains in the same preservative, accountable for by marked differences in the physical characteristics of the organ, others are met with harder to explain. In some instances, as with *Lepus cuniculus*, *Cathartes aura*, and a few others (see detailed lists), there is a suggestion that the difference

<sup>a</sup> In a number of instances the hemispheres of small brains, preserved in weak formalin solution (1 or 2 per cent) in the laboratory, have burst through the great absorption.

may be that of species, which opens a large field of inquiry. But, in other instances, members of the same species, and that even when collected and preserved under much the same conditions, show pronounced differences, and these can hardly be accounted for on other basis than chemical. The following figures show two such instances, (1) in human and (2) in bear's brains:

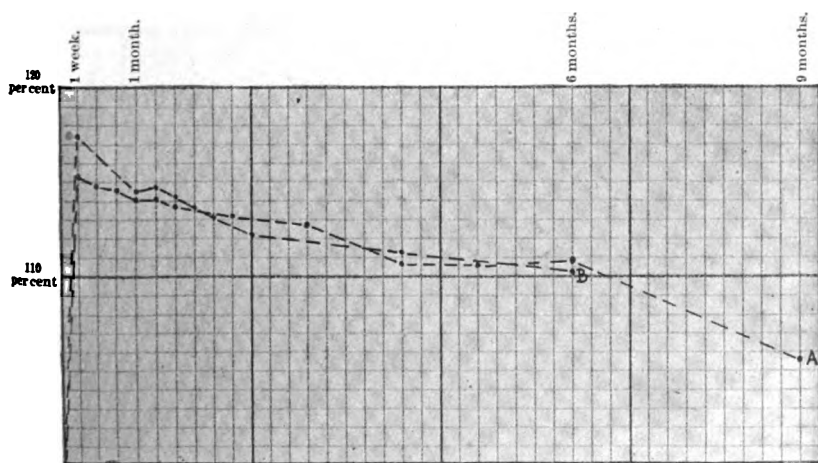


A=brain of a full-blooded negro woman. Received Oct. 6, 1903. Original weight 1,066 grams.

B=brain of a mixed-blooded (about  $\frac{1}{2}$  white,  $\frac{1}{2}$  negro) woman. Received Oct. 14, 1903. Original weight 1,106 grams.

FIG. 1.—CURVES SHOWING DIFFERENCES IN WEIGHT CHANGES OF TWO HUMAN BRAINS IN 5 PER CENT FORMALIN SOLUTIONS.

The principal source of chemical difference between brains capable of affecting their behavior in preservatives is, undoubtedly, decomposition. Concerning individual or perhaps even racial chemical differences in the organ, before decomposition, there is as yet no



A, Cat. No. 224387, U.S.N.M., *Ursus torquatus*. B, Cat. No. 224386, U.S.N.M., *Ursus torquatus*.

FIG. 2.—CURVES SHOWING DIFFERENCES IN WEIGHT CHANGES OF TWO BEAR BRAINS IN 3 PER CENT FORMALIN SOLUTION.

knowledge. The subject presents an attractive and important field for investigation.

The behavior of the brains of the young differs, in general, from that of the adults in the various solutions. Most of the young show a greater initial increase in weight and all suffer a greater eventual loss (see fig. 3).

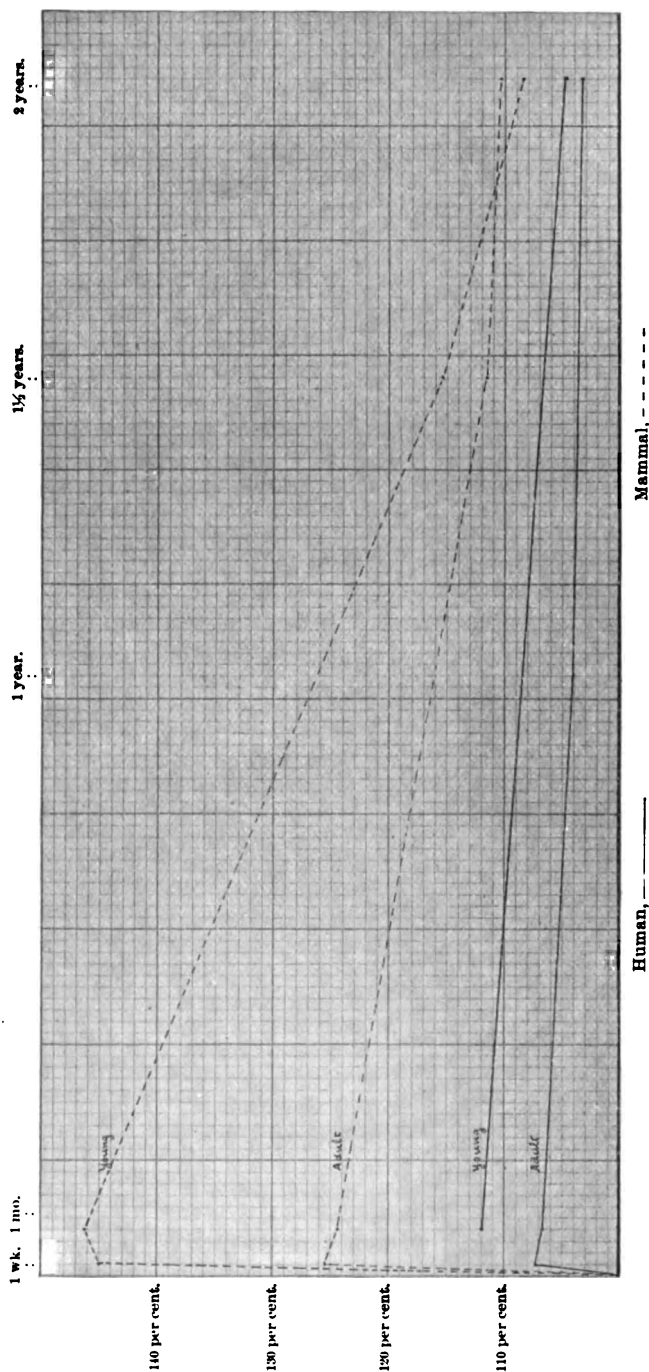
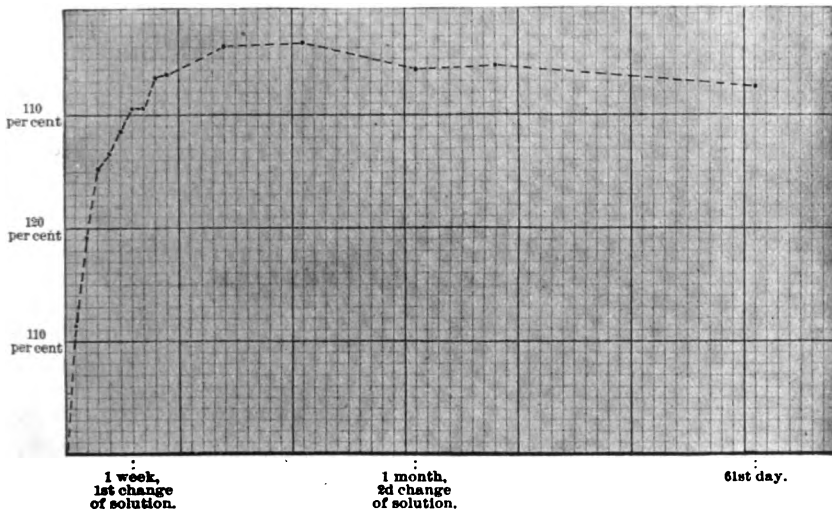


FIG. 3.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 3 PER CENT FORMALIN SOLUTION.

## BRIEF DETAILS CONCERNING THE VARIOUS PRESERVATIVES.

## THREE PER CENT FORMALIN SOLUTION.

All specimens increased in weight, mammal brains more than human; brains of the young, human and mammal, increased more than those of adults. A decrease in weight in all classes of specimens set in within the first month and continued slowly as far as observed (two years). In every instance the weight of the brain at the end of two years was still greater than the original.



Cat. No. 224803, U.S.N.M. *Phoca vitul*, 3 per cent formalin.

FIG. 4.—CURVE SHOWING CHANGES IN BRAIN WEIGHTS IN 3 PER CENT FORMALIN SOLUTION.

## FIVE PER CENT FORMALIN SOLUTION.

All specimens rose in weight, but the young, at least, less so than in the 3 per cent solution; mammal brains augmented more than human; some of the brains of the young showed a greater increase, some a little less than the average of the corresponding series of adults. A decrease in weight in all specimens set in within the first month, and continued slowly for at least eighteen months. At the end of one to one and one-half years the weight of the adult human and mammal brains was in most instances still above the original; in the case of the young, in one human and one mammal it was above, in one human and one mammal well below, the original.

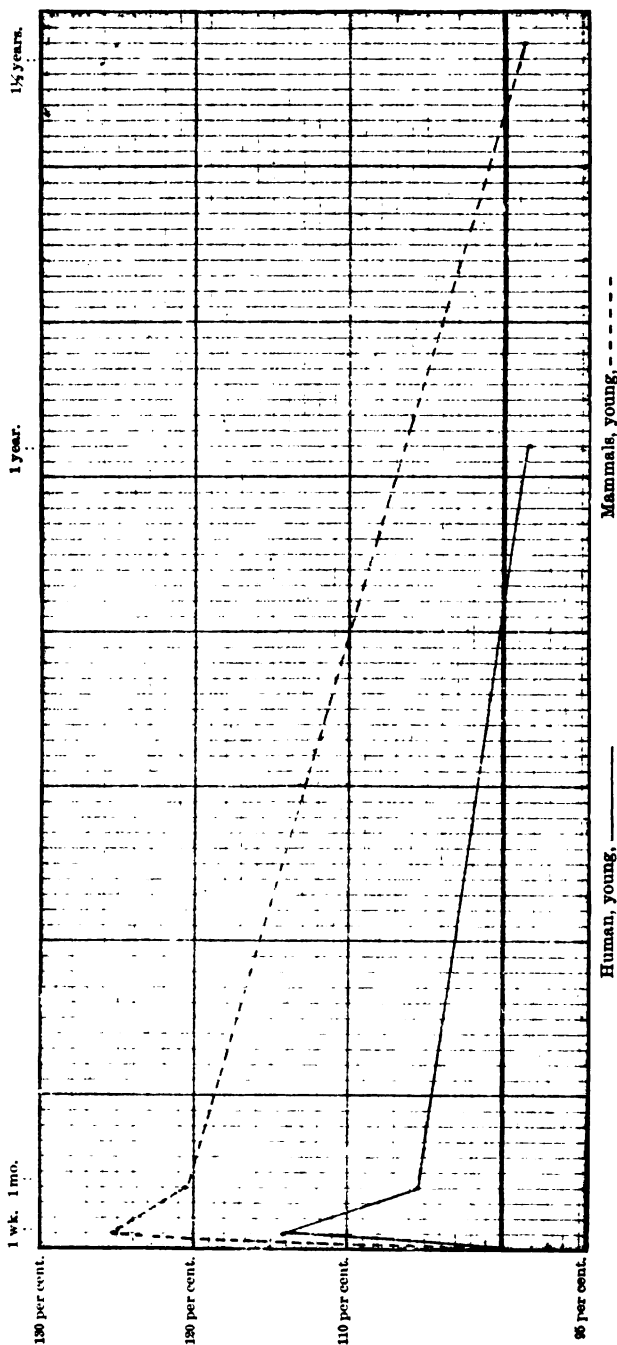


FIG. 5d.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 5 PER CENT FORMALIN SOLUTION.

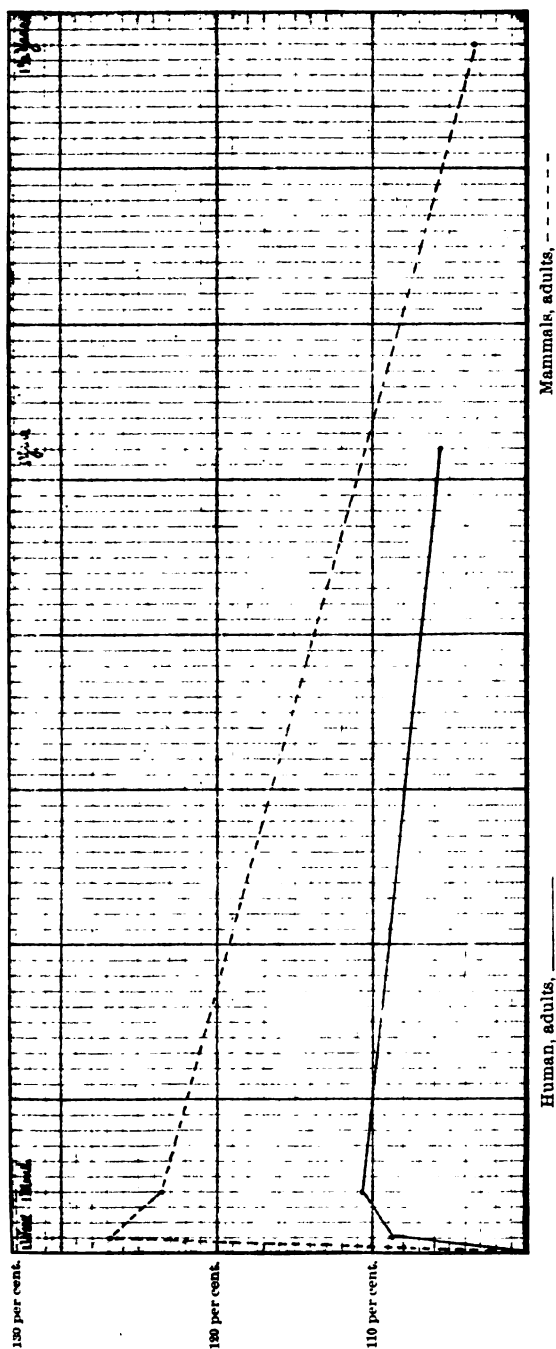


FIG. 56.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 5 PER CENT FORMALIN SOLUTION.

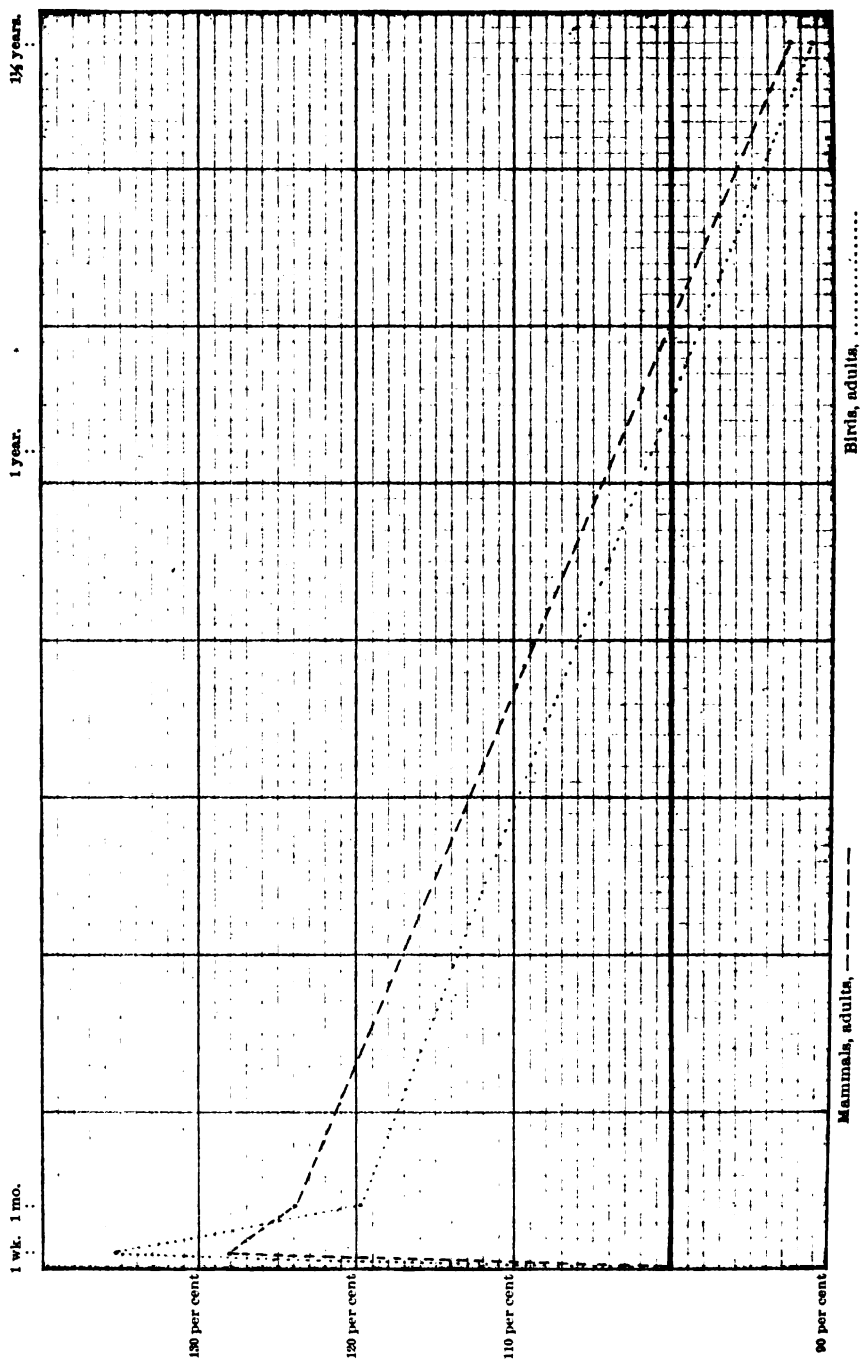


FIG. 6.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 10 PER CENT FORMALIN SOLUTION.

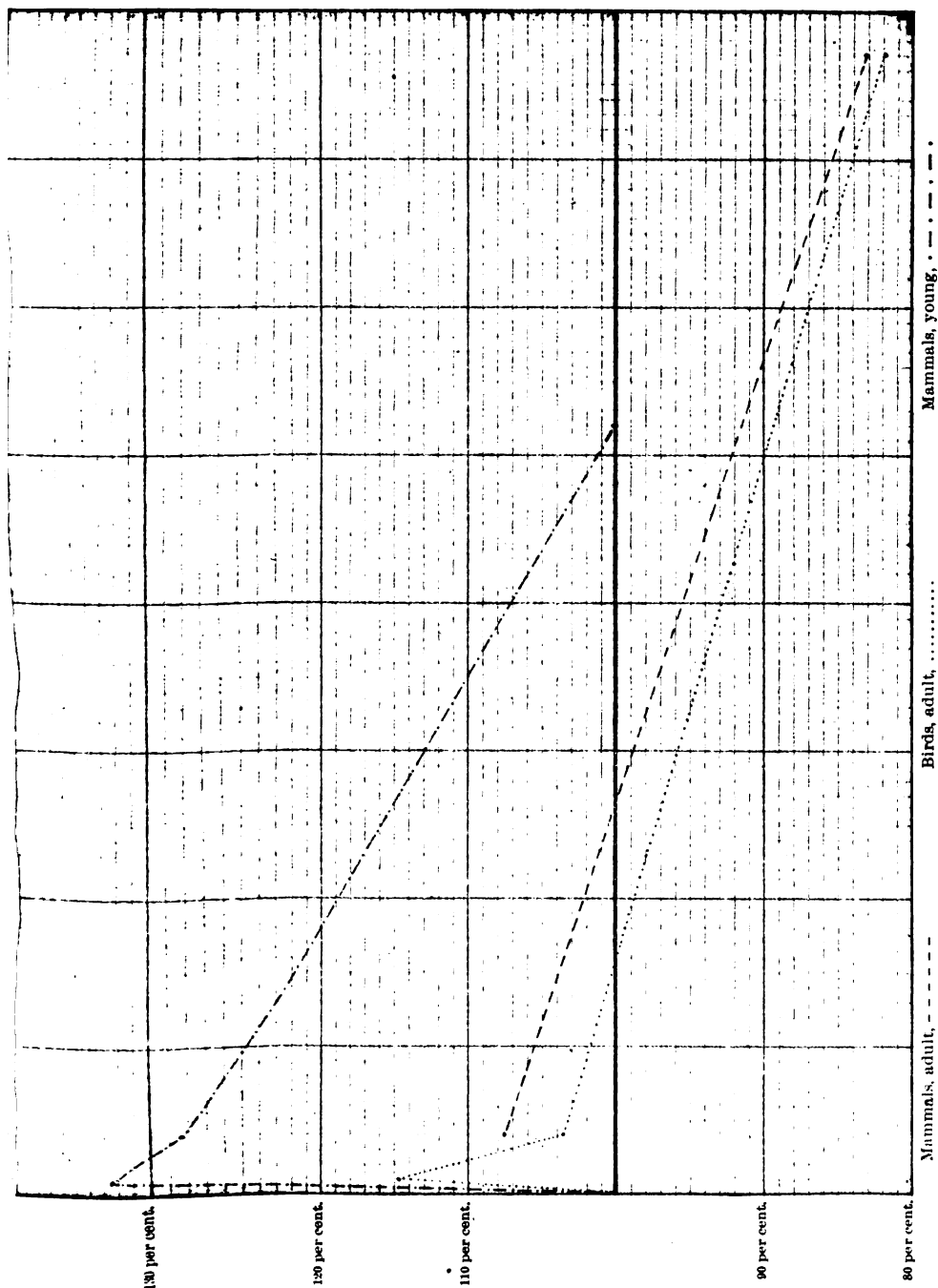


FIG. 7.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 15 PER CENT FORMALIN SOLUTION.

## TEN PER CENT AND 15 PER CENT FORMALIN SOLUTIONS.

In these the number of mammals was rather small and all were of small size, which had an effect on the figures. All the specimens increased in weight, as in the 3 per cent and 5 per cent formalin solutions, during the early part of the first month, and slowly and continuously declined afterwards. The ultimate weight reached was in every case, and particularly in the 15 per cent liquid, lower than with the weaker solutions. It was greater in the birds than in the mammals. Experiments on the larger and more uniform brains of sheep showed plainly a progressively less initial augmentation and lower subsequent fall in weight with the increase in strength of the formalin to 10 and 15 per cent.

## 1,030 AND 1,035 SPECIFIC GRAVITY SALT SOLUTIONS, WITH 5 PER CENT FORMALIN.

These two solutions acted practically alike; the 1,030 sp. gr. liquid was more largely used, for the reason that fewer brains will float in it.

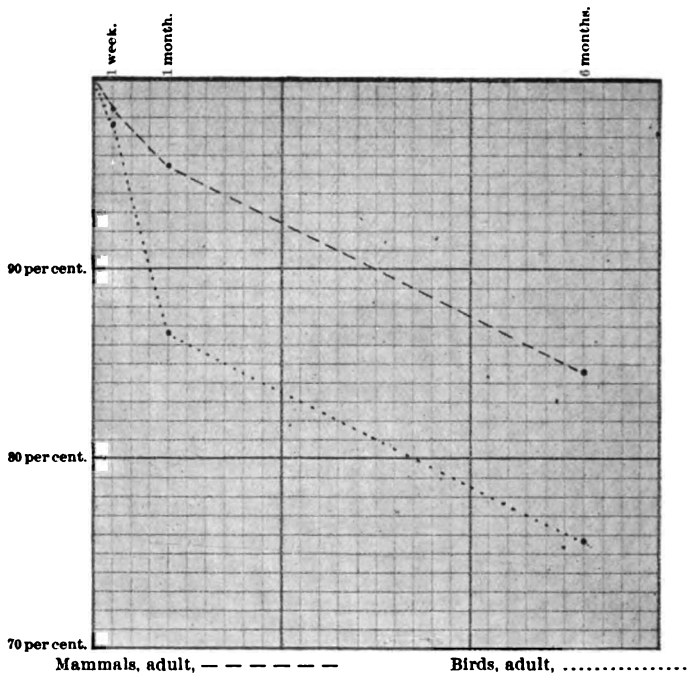


FIG. 8.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN 1,030 SPECIFIC GRAVITY SALT FORMALIN SOLUTION.

Only adult mammal and bird brains were preserved in the solution, no normal human or young specimens having reached the laboratory while it was being employed. A large majority of brains in both series showed at the end of the first week a decided loss in weight,

and this gradually progressed. The bird brains showed greater loss than those of mammals. On the whole the effects of the solution resemble those of the alum-formalin combinations.

ONE-HALF SATURATED SOLUTION OF ALUM, WITH 5 PER CENT FORMALIN.

The various series of specimens in this solution behaved in the same way as those in one-half saturated solution of alum with 10 per cent

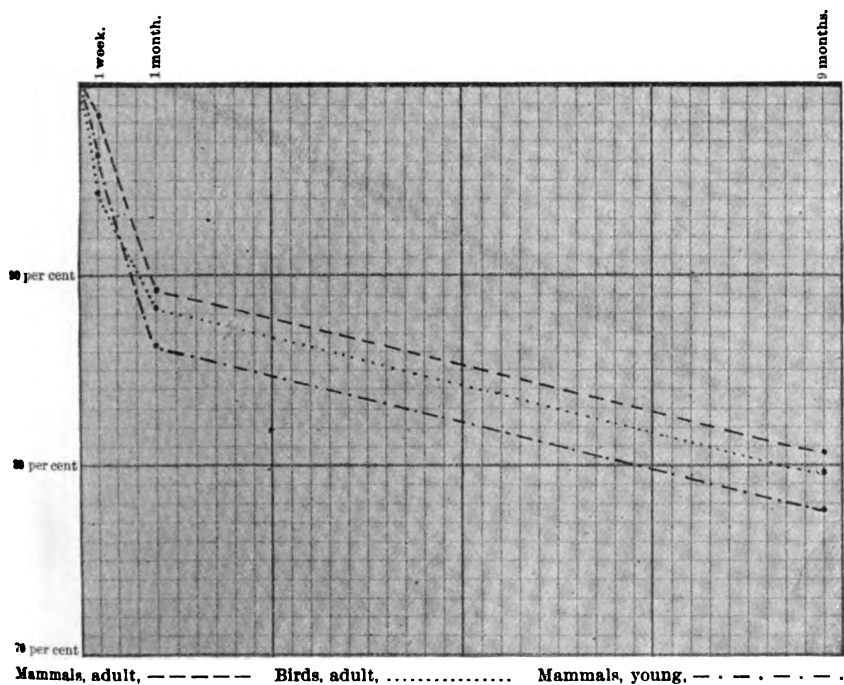


FIG. 9.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN ONE-HALF SATURATED SOLUTION OF ALUM, WITH 5 PER CENT FORMALIN.

formalin, except that the loss was throughout slightly less. An increased amount of formalin with this alum solution favored somewhat a loss of weight of the specimens.

## ONE-HALF SATURATED SOLUTION OF ALUM, WITH 10 PER CENT FORMALIN.

At the end of the first week one human specimen showed a small increase, another a slight diminution in weight; among the mammals, two adults and two young showed a very slight increase, the rest of the mammals and all the birds a decrease in the original weight. Apparently there was an initial rise, but it was slight and of short

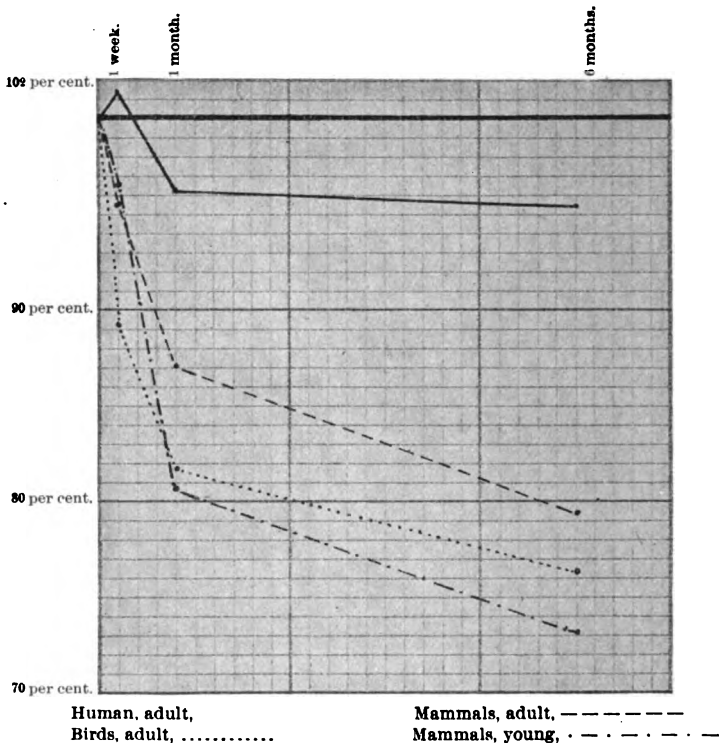


FIG. 10.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN ONE-HALF SATURATED SOLUTION OF ALUM, WITH 10 PER CENT FORMALIN.

duration. The brains of adult birds lost more than those of full-grown mammals, and these lost more than the adult human brains. Brains of young mammals lost more than those of full-grown. The ultimate deficiency in weight was greater than in any of the simple formalin solutions.

## ONE-THIRD SATURATED SOLUTION OF ALUM, WITH 5 PER CENT FORMALIN.

This preservative influenced the weight in the various series of specimens much as did the one-half saturated alum solutions, only the loss of weight was on the whole still slightly smaller. The one adult human brain preserved in this liquid showed a slight initial increase, but in the mammal and bird brains there was at the end of a week in

most cases already a decided loss. The brains of the young, both human and mammal, with one exception, lost more than those of the adults. The brains of adult mammals and birds behaved generally much alike in this solution.

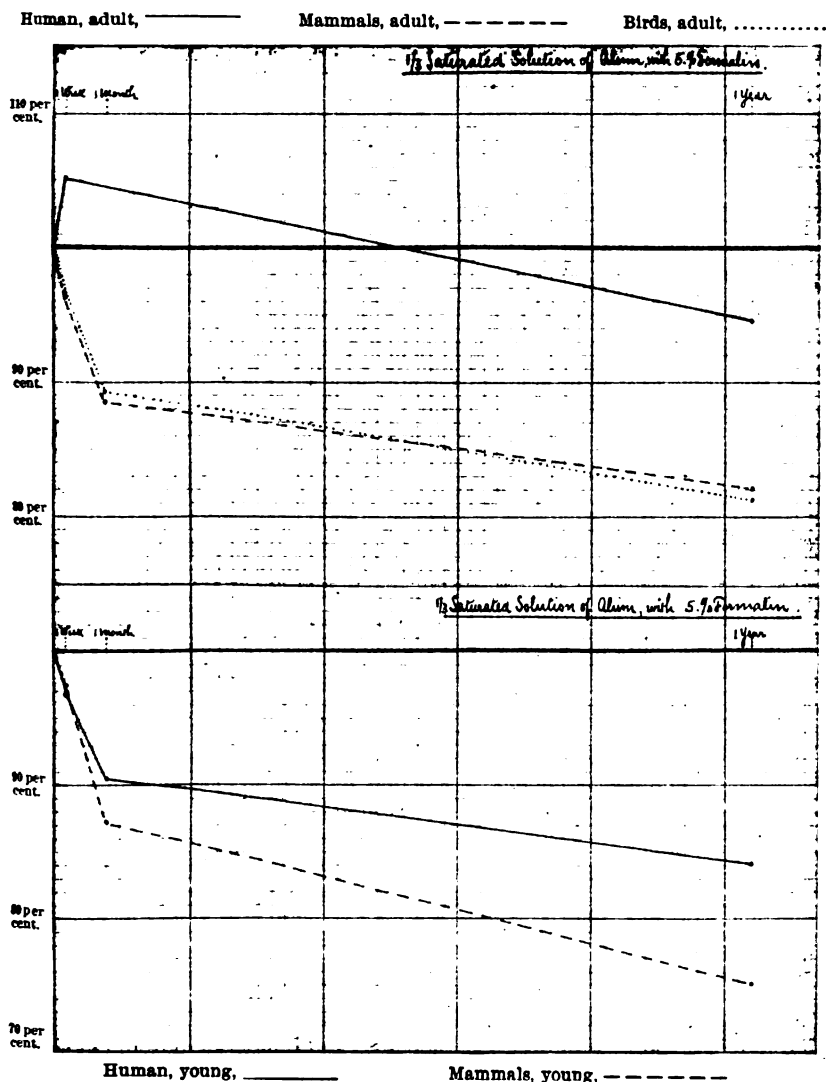


FIG. 11.—CURVES SHOWING CHANGES IN BRAIN WEIGHTS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

The data here recorded make it plain that no single formalin brain preservative meets all the requirements, even for macroscopical purposes alone. If it is desired to preserve specimens of a mixed (human and comparative) collection near their actual weight and volume, two

or three solutions of different concentration for brains of widely different mass would seem to be needed.

Highly diluted (less than 5 per cent) and again highly concentrated (over 15 per cent) formalin solutions, and large additions of salts, are disadvantageous and ought not to be employed.

Addition of alum to the formalin solution favors the process of hardening, and is to be recommended in preserving brains of the young, particularly of human fetuses.

Among the numerous points left to be determined are the effects of additional solutions, the influence of different quantities of the preservative, and the exact daily changes during the first month at least in the specimens. Experiments made in the laboratory during the past summer with fifteen series of sheep brains and reported in Part II, will throw some light on these matters.

The changes in individual brains of this first series are given in the following tables:

## DETAIL DATA.

Solution: 3 per cent of formalin.

| Catalogue No. | Subject.                 | Date of autopsy. | Age.            | Condition of brain.  | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of brain original weight. | Weight of brain after 1 month. | Per cent of brain original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of brain original weight. | Weight of brain after 18 months. | Per cent of brain original weight. | Weight of brain after 2 years. | Per cent of brain original weight. |
|---------------|--------------------------|------------------|-----------------|----------------------|---|-------------------------------|------------------------------------|--------------------------------|------------------------------------|---|-------------------------------|------------------------------------|----------------------------------|------------------------------------|--------------------------------|------------------------------------|
|               |                          |                  |                 |                      | Grams.  | Grams.                        |                                    | Grams.                         |                                    |   | Grams.                        |                                    | Grams.                           |                                    | Grams.                         |                                    |
| 220874        | Negro (full blood) . . . | July 28, 1903    | About 55 years. | Some congestion.     | 1,125.0                                       | 1,207.0                       | 107.29                             | 1,202.0                        | 106.84                             | -0.42   | 1,171.7                       | 104.1                              |                                  |                                    | 1,183.5                        | 108.41                             |
| 224395        | Vulpes arbitronensis.    | Aug. 17, 1903    | Adult           | Medium               | 40.0  | 55.0                          | 137.50                             | 54.0                           | 135.00                             | -1.82   |                               |                                    |                                  |                                    | 44.5                           | 111.25                             |
| 224396        | Ursus torquatus . . .    | Aug. 29, 1903    | 3 years.        | do                   | 269.0   | 316.0                         | 117.47                             | 308.0                          | 114.50                             | -2.53   |                               |                                    |                                  |                                    | 295.3                          | 109.78                             |
| 224397        | do . . .                 | Sept. 11, 1903   | do              | do                   | 282.0   | 325.0                         | 115.25                             | 321.5                          | 114.00                             | -1.08   |                               |                                    |                                  |                                    | 303.0                          | 106.73                             |
| 224398        | Macropus sp? . . .       | Sept. 8, 1903    | Adult           | do                   | 37.0  | 49.0                          | 132.43                             | 47.5                           | 126.38                             | -3.06   |                               |                                    |                                  |                                    | 40.5                           | 109.46                             |
| 224821        | Odocoileus virginianus.  | Oct. 28, 1903    | do              | do                   | 203.0   | 234.0                         | 115.27                             | 236.5                          | 116.50                             | +1.07   |                               |                                    | 213.3                            | 105.07                             |                                |                                    |
| 224389        | Odocoileus truei . . .   | Sept. 26, 1903   | do              | do                   | 129.0   | 168.0                         | 130.24                             | 172.0                          | 133.33                             | +2.38   |                               |                                    | 146.8                            | 113.80                             |                                |                                    |
| 224907        | Sus scrofa . . .         | Oct. 30, 1903    | do              | Moderate congestion. | 186.0   | 233.5                         | 125.54                             | 238.0                          | 127.96                             | +1.92   |                               |                                    | 216.2                            | 116.24                             |                                |                                    |
| 224427        | Lepus . . .              | Oct. 5, 1903     | do              | Medium               | 11.5  | 15.5                          | 134.78                             | 15.6                           | 135.65                             | +64   |                               |                                    | 12.8                             | 111.30                             |                                |                                    |
| 224382        | Ursus americanus . . .   | Aug. 14, 1903    | Nearly adult.   | do                   | 230.0   | 273.0                         | 118.69                             | 284.0                          | 114.78                             | +3.30   |                               |                                    |                                  |                                    | 256.5                          | 111.52                             |
| 224380        | Felis onca . . .         | Aug. 1, 1903     | Adolescent.     | do                   | 165.0   | 210.0                         | 127.27                             | 205.0                          | 124.24                             | -2.38   |                               |                                    |                                  |                                    | 185.5                          | 112.42                             |
| 224381        | do . . .                 | Aug. 5, 1903     | do              | do                   | 160.0   | 203.0                         | 126.87                             | 193.0                          | 124.37                             | -1.93   |                               |                                    |                                  |                                    | 179.0                          | 111.87                             |
| 218059        | Negro child . . .        | May 8, 1903      | New born        | do                   | 375.0   |                               |                                    | 420.0                          | 112.00                             | ?   |                               |                                    |                                  |                                    | 398.2                          | 104.85                             |
| 224385        | Ursus japonicus . . .    | Aug. 11, 1903    | Young           | do                   | 230.0   | 272.0                         | 118.26                             | 267.0                          | 116.08                             | -1.84   |                               |                                    |                                  |                                    | 248.5                          | 108.04                             |
| 224391        | Odocoileus hemionus.     | Oct. 13, 1903    | do              | do                   | 116.5   | 167.0                         | 143.85                             | 168.0                          | 144.20                             | +59   |                               |                                    |                                  |                                    |                                |                                    |
| 224428        | Lepus . . .              | Oct. 5, 1903     | do              | do                   | 6.9   | 10.3                          | 149.27                             | 10.1                           | 146.37                             | -1.94   |                               |                                    | 7.7                              | 111.60                             |                                |                                    |
| 224429        | do . . .                 | do               | do              | do                   | 6.8   | 11.5                          | 169.12                             | 11.3                           | 166.17                             | -1.74   |                               |                                    | 8.86                             | 130.15                             |                                |                                    |
| 224430        | Cavia cutleri . . .      | Oct. 7, 1903     | ?               | do                   | 4.8   |                               |                                    | 7.3                            | 152.08                             | ?   |                               |                                    | 5.07                             | 105.63                             |                                |                                    |
| 224431        | do . . .                 | do               | do              | do                   | 4.9   |                               |                                    | 7.5                            | 153.06                             | ?   |                               |                                    | 5.60                             | 114.29                             |                                |                                    |

*Solution: 3 per cent of formalin—Continued.*

AVERAGES.

| Subject.       | Per cent of original weight— |                            |               |                  | Subject.                  | Per cent of original weight— |                           |                            |               |                  |
|----------------|------------------------------|----------------------------|---------------|------------------|---------------------------|------------------------------|---------------------------|----------------------------|---------------|------------------|
|                | At the end of first week.    | At the end of first month. | After 1 year. | After 18 months. |                           | After 2 years.               | At the end of first week. | At the end of first month. | After 1 year. | After 18 months. |
| ADULT.         |                              |                            |               |                  |                           |                              |                           |                            |               |                  |
| Human subjects | (1) 107.29                   | (1) 106.81                 | (1) 104.10    | (1) 103.41       | Human subjects<br>Mammals |                              |                           |                            |               | (1) 104.85       |
| Mammals        | (11) 125.57                  | (11) 124.43                | (4) 111.60    | (7) 110.43       |                           |                              |                           |                            |               | (4) 116.42       |
|                |                              |                            |               |                  | YOUNG.                    |                              |                           |                            |               |                  |
|                |                              |                            |               |                  | Human subjects            |                              |                           |                            |               |                  |
|                |                              |                            |               |                  | Mammals                   |                              |                           |                            |               |                  |
|                |                              |                            |               |                  |                           | (4) 145.00                   | (1) 112.00                |                            |               |                  |
|                |                              |                            |               |                  |                           |                              | (6) 146.33                |                            |               |                  |

*Solution: 5 per cent of formalin.*

| Catalogue No. | Subject.                                | Date of autopsy. | Age.      | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. | Weight of brain after 18 months. | Per cent of original weight. |
|---------------|---|------------------|-----------|---------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-------------------------------|------------------------------|----------------------------------|------------------------------|
| 219999        | White man.                              | July 15, 1903    | 51 years. | Medium              | 1,400.0                                       | 1,507.0                       | 107.64                       | 1,464.0                        | 104.56                       | -1.16   | 1,110.0                       | 104.12                       |                                  |                              |
| 222991        | Negro woman (full blood).               | Oct. 6, 1903     | 59 years. | Some congestion.    | 1,066.0                                       | 1,166.5                       | 109.54                       | 1,153.0                        | 113.43                       | +3.55   | 1,181.3                       | 107.02                       |                                  |                              |
| 222576        | Negro woman (one-eighth or less negro). | Oct. 11, 1903    | 43 years. | Medium              | 1,103.7                                       | 1,209.0                       |                              | 1,252.0                        |                              |   |                               |                              |                                  |                              |
| 224742        | Ursus horribilis                        | Feb. 6, 1904     | Adult     | do                  | 389.0   | 466.0                         | 119.79                       | 473.0                          | 121.59                       | +1.50   |                               |                              | 437.0                            | 112.40                       |
| 224824        | Canis nubilus                           | Dec. 19, 1903    | do        | do                  | 115.5   | 145.0                         | 125.54                       | 145.0                          | 125.54                       |   |                               |                              | 128.5                            | 111.26                       |
| 224826        | "Black and tan" terrier.                | Dec. 15, 1903    | do        | do                  | 70.0  | 86.0                          | 122.86                       | 84.5                           | 120.71                       | -1.75   |                               |                              | 88.0                             | 97.14                        |
| 224822        | "Retriever" dog.                        | Dec. 19, 1903    | do        | do                  | 90.5  | 110.0                         | 121.54                       | 110.0                          | 121.54                       |   |                               |                              | 90.5                             | 100.0                        |
| 224825        | Fox terrier.                            | Dec. 15, 1903    | do        | do                  | 80.3  | 119.40                        | 148.68                       | 78.3                           | 116.86                       | -2.49   |                               |                              | 95.0                             | 97.01                        |
| 224814        | "Black and tan" dog.                    | Dec. 23, 1903    | do        | do                  | 67.0  | 76.0                          | 123.57                       | 75.0                           | 121.95                       | -1.32   |                               |                              | 62.0                             | 100.81                       |
| 224815        | Felis pardalis                          | Dec. 24, 1903    | do        | do                  | 63.5  | 76.5                          | 120.47                       | 76.5                           | 120.47                       |   |                               |                              | 68.5                             | 107.87                       |
| 224438        | Lepus                                   | Oct. 24, 1903    | 8.7       | do                  | 12.4  | 14.8                          | 120.16                       | 14.15                          | 127.48                       | -5.65   |                               |                              | 9.95                             | 114.37                       |
| 222600        | Capromys pilorides.                     | Nov. 27, 1903    | do        | do                  | 11.1  | 14.8                          | 133.33                       | 14.15                          | 127.48                       | -4.39   |                               |                              | 11.7                             | 106.41                       |
| 224447        | Sciuropterus volans                     | Nov. 23, 1903    | do        | do                  | 1.92  | 2.88                          | 150.0                        | 2.7                            | 140.62                       | -6.25   |                               |                              | 1.9                              | 98.96                        |

|        |   |               |  |         |         |        |         |        |         |        |
|--------|---|---------------|--|---------|---------|--------|---------|--------|---------|--------|
| 224448 | <i>Sciurus hudsonicus</i> .....         | Nov. 24, 1903 | do.  | 4.02    | 5.76    | 143.25 | 6.5     | 130.51 | 4.32    | 101.99 |
| 224743 | <i>Aleas americanus</i> .....           | Jan. 26, 1904 | do.  | 407.0   | 478.0   | 116.21 | 471.0   | 116.74 | - .45   | 103.32 |
| 224623 | <i>Odocoileus virginianus</i> .....     | Nov. 20, 1903 | do.  | 219.6   | 248.0   | 112.98 | 261.0   | 111.36 | +1.21   | 96.6   |
| 224628 | do.                                     | Nov. 10, 1903 | do.  | 177.6   | 199.7   | 112.51 | 197.6   | 111.27 | -1.11   | 100.26 |
| 224718 | White boy                               | Mar. 26, 1904 | 11 years.                                  | 1,350.0 | 1,522.0 | 112.74 |         |        |         |        |
| 221172 | Negro child (full blood or near).       | Oct. 31, 1903 | Pronounced congenital atrophy of cerebrum. | 1,039.0 | 1,197.0 | 115.21 | 1,180.0 | 113.57 | 1,365.4 | 101.14 |
| 224719 | Colored child (about one-fourth white). | Mar. 23, 1904 | 3 years.                                   | 1,020.0 | 1,167.0 | 114.41 | 993.0   | 97.85  | 974.0   | 95.49  |
| 224910 | Fox terrier puppy                       | Dec. 31, 1903 | Young.                                     | 58.0    | 68.5    | 129.24 | 67.4    | 127.17 | -1.61   | 51.0   |
| 225996 | Shropshire sheep.                       | Jan. 21, 1904 | 9 months.                                  | 112.8   | 137.0   | 121.45 | 136.0   | 120.65 | - .73   | 101.51 |

## AVERAGES.

| Subject.        | Per cent of original weight at the end of— |                           |           |             | Subject.       | Per cent of original weight at the end of— |                          |           |            |
|-----------------|--|---------------------------|-----------|-------------|----------------|--|--------------------------|-----------|------------|
|                 | First week.                                | First month.              | 1 year.   | 18 months.  |                | First week.                                | First month.             | 1 year.   | 18 months. |
| HUMAN SUBJECTS. |  |                           |           |             | YOUNG.         |  |                          |           |            |
| Mammals         | (3) 108.87<br>(11) 126.95                  | (2) 110.80<br>(14) 123.53 | (2) 105.6 | (14) 103.39 | Human subjects | (3) 114.12<br>(2) 125.35                   | (2) 105.46<br>(2) 123.91 | (2) 98.31 | (2) 98.96  |

*Solution: 10 per cent of formalin.*

| Catalogue No. | Subject.                             | Date of autopsy. | Age.                 | Condition of brain. | Weight of brain immediately after extrac-tion. | Weight of brain after 1 week. | Per cent of origi-nal weight. | Weight of brain after 1 month. | Per cent of origi-nal weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of origi-nal weight. | Weight of brain after 18 months. | Per cent of origi-nal weight. |
|---------------|--------------------------------------|------------------|----------------------|---------------------|--|-------------------------------|-------------------------------|--------------------------------|-------------------------------|---|-------------------------------|-------------------------------|----------------------------------|-------------------------------|
| 22530         | <i>Trichosurus fuliginosus</i> ..... | Oct. 29, 1903    | Adult.....           | Medium.....         | Grams.<br>12.9                                 | Grams.<br>15.2                | 117.82                        | Grams.<br>14.66                | 134.64                        | 3.55  | Grams.<br>.....               | .....                         | Grams.<br>12.35                  | 95.73                         |
| 22136         | <i>Lepus</i> .....                   | Oct. 27, 1903    | do.....              | do.....             | 8.0  | 9.85                          | 123.12                        | ?                              | ?                             | ?   | .....                         | .....                         | 7.3                              | 91.25                         |
| 22137         | <i>Sciurus carolinensis</i> .....    | Oct. 28, 1903    | do.....              | do.....             | 6.7  | 9.3                           | 138.80                        | ?                              | ?                             | ?   | .....                         | .....                         | 7.1                              | 91.04                         |
| 22175         | <i>Sciurus volans</i> .....          | Nov. 9, 1903     | do.....              | do.....             | 2.0  | ?                             | ?                             | 2.83                           | 116.50                        | ?   | .....                         | .....                         | 1.95                             | 97.50                         |
| 22116         | <i>Sciurus hudsonicus</i> .....      | Nov. 16, 1903    | do.....              | do.....             | 4.43   | 5.87                          | 132.50                        | 5.58                           | 125.96                        | 4.94  | .....                         | .....                         | 8.9                              | 88.03                         |
| 22444         | <i>Lutreola vison</i> .....          | Nov. 11, 1903    | do.....              | Congestion.....     | 7.9  | ?                             | ?                             | 9.38                           | 118.73                        | ?   | .....                         | .....                         | 7.3                              | 92.41                         |
| 22410         | <i>Corvus brachyrhynchus</i> .....   | Nov. 10, 1903    | do.....              | Medium.....         | 7.3  | 9.4                           | 128.76                        | 9.75                           | 133.56                        | + 3.72  | .....                         | .....                         | 6.75                             | 92.46                         |
| 22413         | do.....                              | Nov. 11, 1903    | do.....              | do.....             | 8.9  | ?                             | ?                             | 10.68                          | 120.00                        | ?   | .....                         | .....                         | 8.39                             | 94.27                         |
| 22415         | <i>Corvus monedula</i> .....         | Nov. 14, 1903    | do.....              | do.....             | 5.35   | ?                             | ?                             | 6.35                           | 118.69                        | ?   | .....                         | .....                         | 5.26                             | 98.32                         |
| 22142         | <i>Mimus polyglottus</i> .....       | Nov. 10, 1903    | do.....              | do.....             | 1.35   | ?                             | ?                             | 1.58                           | 117.03                        | ?   | .....                         | .....                         | 1.25                             | 92.59                         |
| 22411         | <i>Amazona flammea</i> .....         | do.....          | do.....              | do.....             | 8.35   | 11.8                          | 141.31                        | 10.43                          | 124.91                        | -11.61  | .....                         | .....                         | 6.90                             | 81.44                         |
| 22139         | <i>Colaptes auratus</i> .....        | Nov. 4, 1903     | do.....              | do.....             | 2.75   | ?                             | ?                             | ?                              | ?                             | ?   | .....                         | .....                         | 2.55                             | 92.73                         |
| 22433         | <i>Colinus virginianus</i> .....     | Oct. 30, 1903    | do.....              | do.....             | 1.2  | ?                             | ?                             | 1.26                           | 105.0                         | ?   | .....                         | .....                         | 1.05                             | 87.50                         |
| 22435         | <i>Fulica americana</i> .....        | Oct. 24, 1903    | Not fully adult..... | do.....             | 2.7  | 3.4                           | 125.93                        | 3.05                           | 112.96                        | -10.30  | .....                         | .....                         | 2.5                              | 92.59                         |
| 22426         | <i>Amazona leucocephala</i> .....    | Jan. 19, 1904    | Young.....           | do.....             | 7.2  | 8.5                           | 118.05                        | 7.92                           | 110.0                         | -6.82   | .....                         | .....                         | 6.2                              | 86.11                         |

AVERAGES.

| Subject.     | Per cent of original weight at the end of— |              |            | Subject. | Per cent of original weight at the end of— |              |            |
|--------------|--|--------------|------------|----------|--|--------------|------------|
|              | First week.                                | First month. | 18 months. |          | First week.                                | First month. | 18 months. |
| Mammals..... | (4) 128.06                                 | (4) 123.96   | (6) 92.66  | YOUNG.   | (2) 121.99                                 | (2) 111.48   | (2) 90.35  |
| Birds.....   | (2) 135.04                                 | (6) 119.86   | (7) 91.33  |          |  |              |            |
| ADULT.       |  |              |            |          |  |              |            |

Solution: 15 per cent of formalin.

| Catalogue No. | Subject.                | Date of autopsy. | Age.     | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent change of the end of first and end of fourth week. | Weight of brain after 1 year. | Per cent of original weight. | Weight of brain after 18 months. | Per cent of original weight. |
|---------------|-------------------------|------------------|----------|---------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-------------------------------|------------------------------|----------------------------------|------------------------------|
|               |                         |                  |          |                     | Grams.  | Grams.                        | ?                            | Grams.                         | ?                            | ?   | Grams.                        | ?                            | Grams.                           | ?                            |
| 224936        | Sciurus hudsonicus.     | Feb. 26, 1904    | Adult.   | Medium.             | 4.1   | ?                             | ?                            | 4.25                           | 103.66                       | ?   | ?                             | ?                            | 3.4                              | 82.93                        |
| 224915        | Sciurus rufiventris     | Jan. 2, 1904     | do.      | do.                 | 9.05  | ?                             | ?                            | 10.17                          | 112.37                       | ?   | ?                             | ?                            | 8.09                             | 89.39                        |
| 224914        | Mus musculus.           | Dec. 18, 1903    | do.      | do.                 | 4.45  | 0.49                          | 108.89                       | ?                              | ?                            | ?   | ?                             | ?                            | .35                              | 77.78                        |
| 224951        | Geomys bursarius.       | Apr. 18, 1904    | do.      | do.                 | 2.83  | ?                             | ?                            | 3.1                            | 109.54                       | ?   | ?                             | 98.94                        | ?                                | ?                            |
| 224918        | Dasypus maculatus.      | Jan. 2, 1904     | do.      | do.                 | 4.07  | ?                             | ?                            | 4.28                           | 106.16                       | ?   | ?                             | ?                            | 3.35                             | 82.31                        |
| 224954        | Acanthis cannabina.     | Apr. 29, 1904    | do.      | do.                 | .69   | ?                             | ?                            | .8                             | 115.94                       | ?   | ?                             | ?                            | ?                                | ?                            |
| 224940        | Munia oryzivora.        | Mar. 15, 1904    | do.      | do.                 | .75   | ?                             | ?                            | .68                            | 90.67                        | ?   | ?                             | ?                            | .65                              | 86.67                        |
| 224931        | Serinus.                | Feb. 5, 1904     | do.      | do.                 | .56   | ?                             | ?                            | .53                            | 94.64                        | ?   | ?                             | ?                            | .48                              | 85.71                        |
| 224906        | Alauda arvensis.        | Dec. 16, 1903    | do.      | do.                 | .7  | .78                           | 111.43                       | .71                            | 101.43                       | -8.96   | ?                             | ?                            | .6                               | 85.71                        |
| 224450        | Zonotrichia albicollis. | Nov. 30, 1903    | do.      | do.                 | 1.07  | 1.2                           | 112.15                       | 1.07                           | 100.00                       | -10.84  | ?                             | ?                            | .8                               | 74.77                        |
| 224923        | Turtur risorius.        | Jan. 12, 1904    | do.      | do.                 | 1.05  | ?                             | ?                            | 1.03                           | 98.09                        | ?   | ?                             | ?                            | .83                              | 79.05                        |
| 224918        | Pipilo pouter pigeon.   | Jan. 5, 1904     | do.      | do.                 | 2.0   | ?                             | ?                            | 1.99                           | 99.50                        | ?   | ?                             | ?                            | 1.6                              | 80.00                        |
| 224945        | Ice pigeon.             | Mar. 29, 1904    | do.      | do.                 | 2.12  | ?                             | ?                            | 2.0                            | 94.34                        | ?   | ?                             | ?                            | ?                                | ?                            |
| 224902        | Psittacus erithacus.    | Dec. 3, 1903     | do.      | do.                 | 9.75  | 11.18                         | 114.66                       | 10.56                          | 108.31                       | -5.56   | ?                             | ?                            | 8.0                              | 82.05                        |
| 224919        | Amazona leucocephala.   | Dec. 7, 1904     | do.      | do.                 | 6.9   | 8.27                          | 119.85                       | 7.28                           | 105.51                       | -11.97  | ?                             | ?                            | 5.5                              | 79.71                        |
| 224920        | do.                     | Jan. 9, 1904     | do.      | do.                 | 6.62  | 7.87                          | 118.88                       | 7.15                           | 104.00                       | -9.15   | ?                             | ?                            | 6.3                              | 80.06                        |
| 224922        | Melospiza undulatus.    | Jan. 12, 1904    | do.      | do.                 | 1.2   | ?                             | ?                            | 1.18                           | 98.33                        | -3.62   | ?                             | ?                            | .96                              | 81.67                        |
| 224912        | Aquila chrysaetos.      | Feb. 6, 1904     | do.      | do.                 | 18.06   | 19.35                         | 107.14                       | 18.65                          | 103.27                       | -3.82   | ?                             | ?                            | 15.9                             | 88.04                        |
| 224747        | Falco sparverius.       | Dec. 22, 1903    | do.      | do.                 | 2.75  | ?                             | ?                            | 3.34                           | 121.45                       | ?   | ?                             | ?                            | 8.9                              | 76.72                        |
| 224149        | Cathartes aura.         | Nov. 27, 1903    | do.      | do.                 | 11.6  | ?                             | ?                            | 12.11                          | 104.39                       | -8.81   | ?                             | ?                            | 11.1                             | 81.32                        |
| 224827        | Bubo virginianus.       | Dec. 16, 1903    | do.      | do.                 | 13.65   | 16.7                          | 122.34                       | 15.23                          | 111.57                       | -8.81   | ?                             | ?                            | 5.66                             | 84.33                        |
| 224924        | Pavo cristatus.         | Jan. 12, 1904    | do.      | do.                 | 6.7   | ?                             | ?                            | 7.0                            | 104.48                       | ?   | ?                             | ?                            | 3.6                              | 85.31                        |
| 224938        | "Brahma chicken."       | Mar. 12, 1904    | do.      | do.                 | 4.22  | 4.74                          | 112.32                       | 4.28                           | 101.42                       | -9.71   | ?                             | ?                            | 34.0                             | 80.57                        |
| 224925        | Aix galericulata.       | Jan. 12, 1904    | do.      | do.                 | 4.22  | ?                             | ?                            | 4.42                           | 104.74                       | ?   | ?                             | ?                            | ?                                | ?                            |
| 224949        | "White Pekin" duck.     | Apr. 15, 1901    | do.      | do.                 | 6.18  | ?                             | ?                            | 6.57                           | 106.31                       | ?   | ?                             | ?                            | ?                                | ?                            |
| 224744        | Canis occidentalis.     | Apr. 22, 1901    | 30 days. | do.                 | 46.0  | 61.0                          | 132.48                       | 59.0                           | 128.26                       | -3.28   | 46.0                          | 100.0                        | ?                                | ?                            |

## Solution: 15 per cent of formalin—Continued.

## AVERAGES.

| Subject. | Per cent of original weight at the end of— |             |            | Subject. | Per cent of original weight at the end of— |            |            |
|----------|--|-------------|------------|----------|--|------------|------------|
|          | First week.                                | 1 year.     | 18 months. |          | First month.                               | 1 year.    | 18 months. |
| Mammals. | (8) 114.85                                 | (4) 107.68  | (4) 83.10  | YOUNG.   | (1) 132.48                                 | (1) 128.26 | (1) 100.00 |
| Birds.   | (20) 108.61                                | (20) 108.61 | (16) 81.98 |          |  |            |            |

## Solution: 1,030 specific gravity salt solution with 5 per cent formalin.

| Catalogue No. | Subject.                 | Date of autopsy. | Age.   | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 6 months. | Per cent of original weight. |
|---------------|--------------------------|------------------|--------|---------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|---------------------------------|------------------------------|
|               |                          |                  |        |                     |   |                               |                              |                                |                              |   |                                 |                              |
| 228209        | Midas ocellus.           | Apr. 24, 1906    | Adult. | Medium.             | 8.8   | 8.6                           | 97.72                        | 8.0                            | 90.91                        | 8.14  | 23.0                            | 90.19                        |
| 228139        | Lemur macaco.            | Feb. 6, 1906     | do.    | do.                 | 25.6  | 25.8                          | 101.17                       | 26.5                           | 100.00                       | 1.17  | 23.0                            | 90.42                        |
| 228143        | Lemur varus.             | Feb. 17, 1906    | do.    | do.                 | 24.0  | 24.8                          | 103.33                       | 23.9                           | 99.58                        | 3.63  | 21.7                            | 90.19                        |
| 228160        | Mustela americana.       | May 4, 1906      | do.    | do.                 | 15.3  | 15.1                          | 94.92                        | 14.7                           | 96.06                        | 2.65  | 235.0                           | 88.01                        |
| 228150        | Mustela ursinus.         | Mar. 11, 1906    | do.    | do.                 | 267.0   | 251.0                         | 94.00                        | 248.5                          | 93.07                        | 1.00  | 34.0                            | 85.00                        |
| 228136        | Felis yagouaroundi.      | Feb. 1, 1906     | do.    | do.                 | 40.0  | 39.0                          | 97.50                        | 38.0                           | 95.00                        | 2.56  | 136.0                           | 85.26                        |
| 228134        | Felis onca.              | Jan. 30, 1906    | do.    | do.                 | 159.5   | 155.5                         | 97.49                        | 152.5                          | 95.61                        | 1.93  | 105.6                           | 87.19                        |
| 228131        | do.                      | Jan. 19, 1906    | do.    | do.                 | 121.0   | 119.0                         | 98.34                        | 117.0                          | 96.69                        | 1.68  | 46.3                            | 81.66                        |
| 228154        | Lynx canadensis.         | Mar. 29, 1906    | do.    | do.                 | 69.5  | 67.5                          | 97.12                        | 66.5                           | 95.68                        | 3.57  | 18.3                            | 75.62                        |
| 228129        | do.                      | Jan. 27, 1906    | do.    | do.                 | 56.7  | 56.0                          | 98.76                        | 54.0                           | 95.23                        | 4.26  | 9.23                            | 77.19                        |
| 228122        | Hystrix cristata.        | Jan. 30, 1906    | do.    | do.                 | 24.2  | 23.5                          | 97.11                        | 22.5                           | 92.98                        | 7.90  | 9.18                            | 81.62                        |
| 228168        | Perodipus richardsoni.   | Apr. 18, 1906    | do.    | do.                 | 7.3   | 7.22                          | 98.90                        | 6.65                           | 92.31                        | 11.16   | 184.0                           | 87.83                        |
| 228144        | do.                      | Feb. 31, 1906    | do.    | do.                 | 11.09   | 11.2                          | 100.99                       | 9.95                           | 89.72                        | 1.18  | 170.5                           | 90.55                        |
| 228135        | Capromys pilorides.      | Jan. 31, 1906    | do.    | do.                 | 10.55   | 10.6                          | 100.47                       | 10.72                          | 101.61                       | 5.62  | 113.5                           | 89.09                        |
| 228151        | Ovis tragelaphus.        | Mar. 11, 1906    | do.    | do.                 | 209.5   | 205.6                         | 98.09                        | 201.6                          | 96.18                        | 1.55  | 135.0                           | 86.94                        |
| 228156        | Boselaphus tragocamelus. | Apr. 6, 1906     | do.    | do.                 | 258.0   | 249.0                         | 96.51                        | 255.0                          | 96.45                        | 1.18  | 96.73                           | 94.30                        |
| 228147        | Odocoileus columbianus.  | Feb. 27, 1906    | do.    | do.                 | 184.3   | 183.0                         | 97.18                        | 182.0                          | 96.51                        | 3.75  | 30.0                            | 86.94                        |
| 228149        | Odocoileus truei.        | Feb. 6, 1906     | do.    | do.                 | 127.4   | 127.0                         | 99.68                        | 125.6                          | 98.51                        | 1.52  | 30.0                            | 86.94                        |
| 228140        | Petrogale sp.?           | Mar. 6, 1906     | do.    | do.                 | 39.8  | 40.0                          | 100.50                       | 38.6                           | 96.73                        | 1.52  | 30.0                            | 86.94                        |
| 228148        | do.                      | Mar. 2, 1906     | do.    | do.                 | 84.5  | 83.0                          | 98.65                        | 82.5                           | 94.30                        | 1.52  | 30.0                            | 86.94                        |

|        |  |               |    |    |       |       |        |       |       |         |       |       |
|--------|--|---------------|----|----|-------|-------|--------|-------|-------|---------|-------|-------|
| 228142 | <i>Onychogale frenata</i> .....        | Feb. 9, 1905  | do | do | 16.2  | 15.95 | 96.45  | 10.7  | 95.01 | - 1.67  | 13.5  | 83.83 |
| 228143 | <i>Trichosurus vulpecula</i> .....     | Feb. 20, 1905 | do | do | 9.7   | 9.8   | 101.03 | 9.6   | 97.43 | - 3.05  | 7.75  | 70.90 |
| 228141 | do                                     | Feb. 8, 1905  | do | do | 11.0  | 11.05 | 100.45 | 10.02 | 96.54 | + 3.67  | 8.05  | 78.64 |
| 224995 | <i>Cyanocitta cristata</i> .....       | Jan. 9, 1905  | do | do | 2.98  | 2.9   | 97.32  | 2.65  | 88.92 | - 8.62  | 2.2   | 75.50 |
| 228206 | <i>Fringilla canebis</i> .....         | Apr. 17, 1905 | do | do | 1.35  | 1.2   | 94.87  | .6    | 64.10 | - 32.43 | ..... | ..... |
| 228205 | Turtle dove.....                       | Apr. 17, 1905 | do | do | 1.35  | 1.2   | 94.89  | 1.05  | 77.78 | - 12.50 | ..... | ..... |
| 224997 | <i>Melospiza undulatus</i> .....       | Jan. 25, 1905 | do | do | 7.4   | 7.14  | 96.43  | 1.2   | 85.71 | - 11.11 | .95   | 67.66 |
| 224996 | <i>Buteo lineatus</i> .....            | Jan. 5, 1905  | do | do | 10.8  | 11.05 | 96.48  | 6.52  | 88.11 | - 8.69  | 5.4   | 72.97 |
| 228201 | <i>Cathartes aura</i> .....            | Jan. 30, 1905 | do | do | 9.85  | 10.1  | 102.31 | 9.6   | 88.99 | - 13.13 | 8.9   | 82.41 |
| 228202 | do                                     | Feb. 11, 1905 | do | do | 3.45  | 3.35  | 102.51 | 9.3   | 94.42 | - 7.92  | 7.45  | 75.63 |
| 228203 | <i>Ardea tricolor ruficollis</i> ..... | Feb. 2, 1905  | do | do | 3.4   | 3.1   | 97.17  | 3.19  | 92.46 | - 4.78  | 2.5   | 72.46 |
| 228137 | do                                     | Apr. 27, 1905 | do | do | 6.15  | 6.16  | 100.00 | 4.7   | 79.41 | - 12.91 | ..... | ..... |
| 228159 | <i>Botaurus lentiginosus</i> .....     | Mar. 23, 1905 | do | do | 14.85 | 15.0  | 101.01 | 14.75 | 99.32 | - 2.00  | 12.5  | 84.18 |
| 228158 | <i>Tartarus loculator</i> .....        | Feb. 23, 1905 | do | do | 3.8   | 3.55  | 93.42  | 3.2   | 94.21 | - 9.86  | ..... | ..... |
| 228145 | "Black Minorca" rooster.....           | Apr. 19, 1905 | do | do | 1.5   | 1.6   | 106.67 | 1.35  | 90.00 | - 16.62 | ..... | ..... |
| 228204 | <i>Lophortyx californicus</i> .....    | Apr. 10, 1905 | do | do | 1.5   | 1.55  | 103.33 | 1.3   | 86.67 | - 16.13 | ..... | ..... |
| 228205 | <i>Callipepla squamata</i> .....       | Apr. 11, 1905 | do | do | 16.4  | 16.27 | 93.21  | 16.2  | 98.78 | - 4.4   | 13.5  | 82.32 |
| 228146 | <i>Cygnus gigas</i> .....              | Feb. 23, 1905 | do | do | 14.0  | 14.0  | 97.29  | 13.7  | 96.14 | - 2.14  | ..... | ..... |
| 228203 | do                                     | Mar. 28, 1905 | do | do | 4.0   | 3.7   | 92.50  | 2.7   | 67.50 | - 27.03 | ..... | ..... |
| 228156 | <i>Anas carolinensis</i> .....         | Apr. 14, 1905 | do | do | 3.45  | 3.7   | 92.50  | 2.9   | 64.06 | - 7.95  | 2.45  | 71.01 |
| 228152 | do                                     | Mar. 14, 1905 | do | do | 7.25  | 7.17  | 96.89  | 6.6   | 91.03 | - 7.95  | 5.35  | 73.79 |
| 228130 | <i>Anas obscura</i> .....              | Jan. 28, 1905 | do | do | ..... | ..... | .....  | ..... | ..... | .....   | ..... | ..... |

## AVERAGES.

| Subject.     | Per cent of original weight at the end of— |              |              | Subject.     | Per cent of original weight at the end of— |              |              |
|--------------|--|--------------|--------------|--------------|--|--------------|--------------|
|              | First week.                                | First month. | Sixth month. |              | First week.                                | First month. | Sixth month. |
| Mammals..... | (24) 98.49                                 | (24) 95.43   | (19) 84.69   | Mammals..... | .....                                      | .....        | .....        |
| Birds.....   | (18) 97.75                                 | (19) 86.72   | (10) 75.81   | Birds.....   | .....                                      | .....        | .....        |
|              |  |              |              | YOUNG.       |  |              |              |

*Solution: 1,035 specific gravity salt solution, with 5 per cent formalin.*

| Catalogue No. | Subject.                             | Date of autopsy. | Age.  | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and fourth week. | Weight of brain after 6 months. | Per cent of original weight. |
|---------------|--------------------------------------|------------------|-------|---------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|--|---------------------------------|------------------------------|
| 228125        | <i>Procyon lotor</i> .....           | Jan. 10, 1905    | Adult | Medium              | Grams. 36.1                                   | Grams. 35.2                   | 97.51                        | Grams. 34.3                    | 95.01                        | -2.56  | Grams. 31.0                     | 85.87                        |
| 228127        | <i>Nasua rufa</i> .....              | Jan. 18, 1905    | do    | do                  | 34.0  | 33.9                          | 99.70                        | 32.5                           | 95.58                        | -4.13  | 29.3                            | 86.18                        |
| 228123        | <i>Felis pardalis</i> .....          | Jan. 9, 1905     | do    | do                  | 62.7  | 63.1                          | 100.63                       | 61.5                           | 98.09                        | -2.54  | 56.5                            | 88.52                        |
| 228122        | <i>Felis caemilii</i> .....          | Jan. 7, 1905     | do    | do                  | 41.9  | 40.9                          | 97.61                        | 39.0                           | 93.08                        | -4.65  | 36.0                            | 85.92                        |
| 228124        | <i>Thylacynus cynocephalus</i> ..... | Jan. 11, 1905    | do    | do                  | 43.0  | 42.3                          | 98.37                        | 41.8                           | 97.21                        | -1.18  | 40.2                            | 93.49                        |
| 228121        | <i>Botaurus lentiginosus</i> .....   | Jan. 6, 1905     | do    | do                  | 4.4   | 4.19                          | 95.23                        | 3.9                            | 88.63                        | -6.92  | 3.3                             | 75.00                        |

## AVERAGES.

| Subject.     | Per cent of original weight at the end of— |              |              | Subject. | Per cent of original weight at the end of— |              |              |
|--------------|--|--------------|--------------|----------|--|--------------|--------------|
|              | First week.                                | First month. | Sixth month. |          | First week.                                | First month. | Sixth month. |
| Mammals..... | (5) 98.76                                  | (5) 95.79    | (5) 88.00    | YOUNG.   |  |              |              |
| Birds.....   | (1) 95.23                                  | (1) 89.63    | (1) 75.00    |          |  |              |              |
|              |  |              |              | Mammals  |  |              |              |
|              |  |              |              | Birds    |  |              |              |

Solution: One-half saturated solution of alum, with 5 per cent formalin.

| Catalogue No. | Subject.                          | Date of autopsy. | Age.            | Condition of brain. | Weight of brain immediately after removal. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 9 months. | Per cent of original weight. | Weight of brain after 1 year. | Per cent of original weight. |
|---------------|-----------------------------------|------------------|-----------------|---------------------|--|-------------------------------|------------------------------|--------------------------------|------------------------------|---|---------------------------------|------------------------------|-------------------------------|------------------------------|
| 224959        | <i>Cercopithecus fuliginosus</i>  | Sept. 2, 1904    | Adult           | Medium              | 108.0                                      | 110.0                         | 104.76                       | 101.5                          | 98.19                        | -17.74  | 83.0                            | 79.05                        |                               |                              |
| 224960        | do.                               | Dec. 15, 1904    | do              | do                  | 108.0                                      | 121.0                         | 112.08                       | 109.8                          | 91.67                        | 9.36  |                                 |                              |                               |                              |
| 224965        | <i>Macacus fascicularis</i>       | Oct. 17, 1904    | do              | do                  | 69.76                                      | 70.5                          | 101.09                       | 63.9                           | 91.67                        | 8.36  | 60.0                            | 86.02                        |                               |                              |
| 224970        | <i>Cercopithecus gallirrhinus</i> | Sept. 24, 1904   | do              | do                  | 71.8                                       | 76.5                          | 108.90                       | 68.9                           | 84.66                        | 9.15  | 64.0                            | 89.01                        |                               |                              |
| 224971        | Marmoset                          | Oct. 24, 1904    | do              | do                  | 8.9  | 8.02                          | 91.13                        | 7.6                            | 84.66                        | 5.24  | 7.15                            | 81.26                        |                               |                              |
| 224972        | do.                               | Oct. 21, 1904    | do              | do                  | 8.9  | 6.65                          | 88.66                        | 6.15                           | 84.66                        | 7.62  | 5.77                            | 81.26                        |                               |                              |
| 224989        | do.                               | do               | do              | do                  | 7.56                                       | 6.65                          | 89.74                        | 5.8                            | 78.92                        | 13.05   | 5.33                            | 79.79                        |                               |                              |
| 224991        | <i>Ptilopus nigriceps</i>         | Oct. 6, 1904     | do              | do                  | 7.77                                       | 7.77                          | 100.0                        | 6.89                           | 88.67                        | 11.83   | 6.2                             | 82.05                        |                               |                              |
| 224992        | do.                               | Oct. 4, 1904     | do              | do                  | 7.8  | 7.2                           | 92.31                        | 6.7                            | 85.89                        | 8.85  | 6.4                             | 82.62                        |                               |                              |
| 224993        | <i>Felis caudivolvulus</i>        | Oct. 17, 1904    | do              | do                  | 85.7                                       | 85.55                         | 101.29                       | 82.0                           | 91.17                        | 9.89  | 29.0                            | 82.62                        |                               |                              |
| 224995        | Fox terrier                       | Oct. 7, 1904     | do              | Slightly congested. | 66.7                                       | 67.7                          | 103.04                       | 61.2                           | 91.63                        | 9.61  | 58.2                            | 88.59                        |                               |                              |
| 224916        | <i>Vulpes velox</i>               | Mar. 5, 1904     | do              | Medium              | 83.35                                      | 86.4                          | 109.15                       | 83.0                           | 98.95                        | -9.34   |                                 |                              |                               |                              |
| 224918        | <i>Canis mesomelas</i>            | Dec. 17, 1904    | do              | do                  | 60.9                                       | 64.2                          | 105.98                       | 53.0                           | 87.46                        | -17.46  |                                 |                              |                               |                              |
| 224974        | Lepus                             | Nov. 4, 1904     | do              | do                  | 9.14                                       | 8.26                          | 91.46                        | ?                              | ?                            | ?   | 6.8                             | 74.40                        |                               |                              |
| 224975        | <i>Lasioprocne agouti</i>         | Nov. 12, 1904    | do              | do                  | 19.0                                       | 19.06                         | 93.73                        | ?                              | ?                            | ?   | 16.5                            | 86.38                        |                               |                              |
| 224976        | <i>Myoprocta aconchy</i>          | Dec. 12, 1904    | do              | do                  | 9.0  | 8.79                          | 93.78                        | 8.49                           | 95.76                        | 3.42  | 4.25                            | 76.03                        |                               |                              |
| 224978        | <i>Fiber zibethicus</i>           | Nov. 8, 1904     | do              | do                  | 5.89                                       | 5.07                          | 89.70                        | 4.7                            | 84.07                        | 7.30  | 2.0                             | 76.92                        |                               |                              |
| 224986        | <i>Rus norvegicus</i>             | Oct. 7, 1904     | do              | do                  | 2.6  | 2.3                           | 88.46                        | 2.05                           | 78.85                        | 10.87   |                                 |                              |                               |                              |
| 224977        | <i>Scluropterus volans</i>        | Nov. 9, 1904     | do              | Above medium.       | 1.8  | 1.59                          | 88.38                        | 1.56                           | 86.11                        | 2.62  | 1.38                            | 76.67                        |                               |                              |
| 228073        | <i>Ovis canadensis</i>            | Aug. 30, 1904    | do              | Medium              | 198.0                                      | 187.3                         | 94.59                        | 171.5                          | 86.62                        | 8.44  |                                 |                              | 157.0                         | 79.29                        |
| 228068        | <i>Antelope cervicapra</i>        | Aug. 17, 1904    | do              | do                  | 114.0                                      | 113.8                         | 94.82                        | 110.8                          | 97.19                        | 2.61  |                                 |                              | 91.0                          | 79.82                        |
| 228092        | <i>Alces americanus</i>           | Nov. 4, 1904     | do              | do                  | 337.2                                      | 345.7                         | 102.52                       | 295.8                          | 84.61                        | -17.46  | 256.5                           | 76.07                        |                               |                              |
| 228074        | <i>Cervus canadensis</i>          | Sept. 23, 1904   | Adult (7 years) | do                  | 461.1                                      | 468.5                         | 101.63                       | 449.0                          | 97.59                        | -4.17   | 429.0                           | 93.04                        |                               |                              |
| 228079        | <i>Cervus dama</i>                | Sept. 24, 1904   | Adult           | do                  | 224.5                                      | 224.8                         | 100.13                       | 216.0                          | 96.21                        | 3.92  | 189.5                           | 84.41                        |                               |                              |
| 228087        | <i>Odocoileus virginianus</i>     | Dec. 22, 1904    | Adult           | do                  | 174.7                                      | 170.7                         | 97.71                        | 156.0                          | 89.29                        | 8.61  | 137.5                           | 78.71                        |                               |                              |
| 228113        | <i>Capreolus caprea</i>           | Dec. 12, 1904    | do              | do                  | 194.5                                      | 188.5                         | 96.95                        | 182.0                          | 93.77                        | 7.35  |                                 |                              |                               |                              |
| 228078        | <i>Odocoileus hemionus</i>        | Sept. 17, 1904   | do              | do                  | 128.2                                      | 118.7                         | 92.59                        | 102.5                          | 79.95                        | 13.65   | 92.0                            | 71.76                        |                               |                              |
| 228072        | do.                               | Aug. 29, 1904    | do              | do                  | 112.0                                      | 105.1                         | 111.69                       | 112.1                          | 104.09                       | -13.65  |                                 |                              | 96.0                          | 85.71                        |
| 228070        | <i>Tayassu tajacu</i>             | Aug. 23, 1904    | do              | do                  | 101.0                                      | 102.07                        | 101.06                       | 91.6                           | 90.69                        | 10.40   |                                 |                              | 85.0                          | 84.16                        |
| 224965        | <i>Cranocitta cristata</i>        | Oct. 15, 1904    | do              | do                  | 3.02                                       | 2.87                          | 95.03                        | 2.83                           | 92.71                        | 2.44  | 2.6                             | 86.09                        |                               |                              |
| 224975        | <i>Ninia</i>                      | Nov. 7, 1904     | do              | do                  | 2.84                                       | 2.27                          | 71.15                        | 2.83                           | 63.46                        | -10.81  | 2.6                             | 85.67                        |                               |                              |
| 228063        | <i>Lanius collurio</i>            | Oct. 11, 1904    | do              | do                  | 2.84                                       | 2.25                          | 94.54                        | 2.08                           | 87.39                        | -7.56   | 1.85                            | 77.73                        |                               |                              |
| 228097        | <i>Parus larva</i>                | Nov. 10, 1904    | do              | do                  | 1.15                                       | .99                           | 86.09                        | .99                            | 86.09                        |   | .85                             | 73.91                        |                               |                              |

*Solution: One-half saturated solution of alum, with 5 per cent formalin—Continued.*

| Catalogue No. | Subject.               | Date of autopsy. | Age.          | Condition of brain. | Weight of brain immediately after removal. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent change of the end of first and end of fourth week. | Weight of brain after 9 months. | Per cent of original weight. | Weight of brain after 1 year. | Per cent of original weight. |
|---------------|------------------------|------------------|---------------|---------------------|--|-------------------------------|------------------------------|--------------------------------|------------------------------|---|---------------------------------|------------------------------|-------------------------------|------------------------------|
| 228068        | Parotia larvata        | Nov. 15, 1904    | Adult.        | Medium              | Grams. 1.25                                | Grams. 1.1                    | 88.00                        | Grams. 1.08                    | 82.40                        | - 6.37  | Grams. .9                       | 72.00                        | Grams.                        |                              |
| 228069        | Parotia cucullata      | do.              | do.           | do.                 | 1.15                                       | 1.04                          | 90.43                        | 1.07                           | 93.04                        | + 2.88  | .88                             | 76.52                        |                               |                              |
| 224973        | Merula merula          | Oct. 27, 1904    | Adult.        | Medium              | 1.6  | 1.5                           | 93.75                        | 1.45                           | 90.62                        | - 3.38  | 1.35                            | 84.37                        |                               |                              |
| 224974        | Oxyphaps lophotes      | Oct. 19, 1904    | do.           | do.                 | 1.72                                       | 1.67                          | 97.09                        | 1.62                           | 94.18                        | - 3.00  | 1.5                             | 87.21                        |                               |                              |
| 224982        | do.                    | Oct. 8, 1904     | do.           | do.                 | 1.67                                       | 1.59                          | 95.21                        | 1.39                           | 83.23                        | -12.58  | 1.3                             | 77.84                        |                               |                              |
| 224978        | Domestic pigeon        | Nov. 9, 1904     | do.           | do.                 | 1.97                                       | 1.77                          | 89.85                        | 1.67                           | 84.77                        | - 5.65  | 1.5                             | 76.14                        |                               |                              |
| 224958        | Amazona parameensis    | Sept. 1, 1904    | do.           | Slight sub-medium.  | 9.46                                       | ?                             | ?                            | 8.4                            | 88.76                        | ?   | 7.6                             | 80.84                        |                               |                              |
| 224960        | do.                    | Sept. 10, 1904   | do.           | Medium              | 8.9  | 7.8                           | 87.64                        | 7.32                           | 82.24                        | - 6.16  | 6.8                             | 76.40                        |                               |                              |
| 224963        | Amazona leucoccephala  | Oct. 11, 1904    | do.           | do.                 | 6.8  | 5.65                          | 97.41                        | 5.32                           | 91.72                        | - 5.84  | 5.15                            | 88.79                        |                               |                              |
| 224972        | do.                    | Oct. 27, 1904    | do.           | do.                 | 8.3  | 7.39                          | 89.03                        | 6.80                           | 81.92                        | - 7.99  | 6.25                            | 75.80                        |                               |                              |
| 224980        | Amazona oratrix        | Nov. 10, 1904    | do.           | do.                 | 10.35                                      | 9.2                           | 88.89                        | 8.4                            | 81.16                        | - 8.70  | 7.65                            | 73.91                        |                               |                              |
| 224981        | Syrnium varium         | Nov. 21, 1904    | do.           | do.                 | 12.5                                       | 12.69                         | 103.12                       | 11.75                          | 94.00                        | - 8.84  | 10.5                            | 84.00                        |                               |                              |
| 224981        | Syrnium varium         | Oct. 6, 1904     | do.           | do.                 | 6.7  | 6.85                          | 102.24                       | 5.95                           | 88.81                        | -13.14  | 5.4                             | 80.59                        |                               |                              |
| 228116        | Syrnium varium         | Dec. 14, 1904    | do.           | do.                 | 14.42                                      | 16.9                          | 117.19                       | 14.3                           | 99.17                        | -10.52  |                                 |                              |                               |                              |
| 228071        | Florida carulea        | Aug. 25, 1904    | do.           | do.                 | 3.7  | 3.52                          | 95.13                        | 3.15                           | 85.13                        | - 8.61  | 3.0                             | 79.37                        |                               |                              |
| 228091        | do.                    | Nov. 2, 1904     | do.           | do.                 | 3.78                                       | 3.72                          | 98.41                        | 3.4                            | 89.95                        | - 4.01  | 3.6                             | 78.96                        |                               |                              |
| 228093        | Plegadis guianensis    | Nov. 12, 1904    | do.           | do.                 | 4.6  | 4.24                          | 92.17                        | 4.07                           | 90.16                        | - 5.99  | 1.0                             | 81.87                        |                               |                              |
| 224979        | Lophortyx californicus | Nov. 10, 1904    | do.           | do.                 | 1.22                                       | 1.12                          | 95.90                        | 1.1                            | 105.45                       | + 3.57  | 1.9                             | 81.87                        |                               |                              |
| 228100        | do.                    | Nov. 16, 1904    | do.           | do.                 | 1.1  | 1.12                          | 101.82                       | 1.16                           | 92.88                        | - 6.26  | 1.1                             | 78.57                        |                               |                              |
| 228102        | do.                    | do.              | do.           | do.                 | 1.4  | 1.39                          | 99.28                        | 1.30                           | 92.88                        | - 5.71  | 6.0                             | 81.63                        |                               |                              |
| 228096        | Larus argentatus       | Nov. 12, 1904    | do.           | do.                 | 7.35                                       | 6.84                          | 93.06                        | 6.45                           | 87.75                        | - 8.23  |                                 |                              |                               |                              |
| 228084        | Phaethon ruber         | Aug. 8, 1904     | do.           | do.                 | 10.26                                      | 9.85                          | 96.00                        | 8.95                           | 87.28                        | - 9.14  |                                 |                              |                               |                              |
| 228067        | do.                    | Aug. 17, 1904    | do.           | do.                 | 10.56                                      | 10.25                         | 97.15                        | 9.4                            | 88.96                        | - 7.46  | 11.7                            | 80.69                        |                               |                              |
| 228101        | Cyrus olor             | Nov. 16, 1904    | do.           | do.                 | 14.5                                       | 13.84                         | 96.14                        | 12.9                           | 88.92                        | - 6.49  | 8.3                             | 78.24                        |                               |                              |
| 224999        | Shufler duck           | Oct. 28, 1904    | do.           | do.                 | 4.19                                       | 3.85                          | 91.88                        | 3.6                            | 85.57                        | - 5.92  | 3.2                             | 78.24                        |                               |                              |
| 225000        | do.                    | do.              | do.           | do.                 | 4.09                                       | 3.72                          | 90.95                        | 3.5                            | 82.69                        | - 4.27  | 2.6                             | 82.64                        |                               |                              |
| 228095        | Nettion carolinensis   | Nov. 12, 1904    | do.           | do.                 | 3.15                                       | 3.05                          | 96.82                        | 2.82                           | 92.69                        | - 8.52  | 2.5                             | 84.75                        |                               |                              |
| 228094        | do.                    | do.              | do.           | do.                 | 2.95                                       | 2.92                          | 98.98                        | 2.80                           | 94.91                        | - 8.52  | 27.0                            | 8.62                         |                               |                              |
| 228104        | Casuarus galeatus      | Nov. 22, 1904    | do.           | do.                 | ?  | 31.7                          | ?                            | 29.0                           | ?                            |   |                                 |                              |                               |                              |
| 228077        | Dromas nove hollandie  | Sept. 17, 1904   | do.           | do.                 | 20.3                                       | 18.8                          | 90.14                        | 17.1                           | 84.23                        | - 6.56  | 15.85                           | 78.08                        |                               |                              |
| 228066        | Felis serval           | Oct. 25, 1904    | Nearly adult. | do.                 | 50.5                                       | 48.9                          | 96.83                        | 42.7                           | 84.55                        | -12.68  | 38.0                            | 75.26                        |                               |                              |
| 228065        | Caprolus caprea        | Oct. 24, 1904    | do.           | do.                 | 103.5                                      | 98.5                          | 95.17                        | 88.45                          | 85.46                        | -10.20  | 80.5                            | 77.78                        |                               |                              |
| 228078        | Trichosurus vulpecula  | Aug. 20, 1904    | Adult.        | do.                 | 8.97                                       | 8.40                          | 94.20                        | 7.45                           | 88.63                        | - 5.92  |                                 |                              |                               |                              |

|        |                        |                |         |         |       |       |       |       |       |       |       |       |       |
|--------|------------------------|----------------|---------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 228075 | Ovis montanus          | Sept. 8, 1904  | 1 year  | .....do | 315.0 | 507.5 | 96.45 | 190.0 | 88.87 | 8.35  | 181.0 | 94.14 | ..... |
| 228076 | Antelope               | Aug. 12, 1904  | Young   | .....do | 371.8 | 501.5 | 96.10 | 241.0 | 82.06 | 7.49  | 99.0  | 92.17 | ..... |
| 228079 | Cervus canadensis      | Sept. 22, 1904 | .....do | .....do | 371.8 | 501.5 | 96.10 | 241.0 | 82.06 | 7.49  | 99.0  | 92.17 | ..... |
| 228080 | Odocoileus virginianus | Sept. 22, 1904 | .....do | .....do | 133.0 | 126.2 | 94.68 | 111.8 | 84.68 | 13.47 | 98.5  | 92.43 | ..... |
| 228084 | Capreolus caprea       | Oct. 12, 1904  | .....do | .....do | 90.0  | 96.7  | 96.83 | 75.5  | 83.89 | 12.92 | 68.5  | 76.11 | ..... |
| 228086 | .....do                | Aug. 17, 1904  | .....do | .....do | 55.0  | 53.75 | 98.76 | 74.5  | 87.65 | 11.05 | ..... | ..... | ..... |

## AVERAGES.

| Subject.     | Per cent of original weight— |                            |                 | Subject.     | Per cent of original weight— |                            |                 |
|--------------|------------------------------|----------------------------|-----------------|--------------|------------------------------|----------------------------|-----------------|
|              | At the end of first week.    | At the end of first month. | After 9 months. |              | At the end of first week.    | At the end of first month. | After 9 months. |
| Mammals..... | (29) 96.43                   | (28) 99.31                 | (20) 80.83      | Mammals..... | (9) 96.30                    | (9) 96.44                  | (6) 77.92       |
| Birds.....   | (32) 94.88                   | (33) 88.81                 | (28) 79.74      | Birds.....   | .....                        | .....                      | .....           |
| ADULT.       |                              |                            |                 | YOUNG.       |                              |                            |                 |
| Mammals..... |                              |                            |                 | Mammals..... |                              |                            |                 |
| Birds.....   |                              |                            |                 | Birds.....   |                              |                            |                 |

*Solution: One-half saturated solution of alum, with 10 per cent formalin.*

| Catalogue No. | Subject.                  | Date of autopsy. | Age.      | Condition of brain. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Weight of brain after 6 months. | Per cent of original weight. |
|---------------|---------------------------|------------------|-----------|---------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|---------------------------------|------------------------------|
| 224845        | Negro man (full blood).   | Nov. 1, 1904     | 45 years. | Medium.             | Grams.<br>1,540.0                             | Grams.<br>1,528.5             | 99.22                        | Grams.<br>1,475.6              | 95.78                        | — 3.47  | Grams.<br>1,467.0               | 95.20                        |
| 224940        | Negro woman (full blood). | Dec. 14, 1904    | Adult.    | do.                 | 1,209.0                                       | 1,254.5                       | 103.72                       | 1,166.7                        | 96.50                        | — 7.00  | 1,157.0                         | 95.70                        |
| 225110        | Ateles geoffroyi.         | Dec. 6, 1904     | do.       | do.                 | 95.5  | 98.5                          | 97.90                        | 86.5                           | 90.57                        | — 7.49  | 79.0                            | 82.72                        |
| 225105        | Lemur varius.             | Dec. 1, 1904     | do.       | do.                 | 21.8  | 20.8                          | 95.41                        | 18.3                           | 83.94                        | — 12.02   | 17.2                            | 78.90                        |
| 225112        | Phoca vitulina.           | Dec. 7, 1904     | do.       | do.                 | 225.0   | 225.7                         | 100.31                       | 216.5                          | 96.22                        | — 4.08  | 179.4                           | 79.73                        |
| 224988        | Putorius putorius.        | Dec. 4, 1904     | do.       | do.                 | 7.87  | 7.2                           | 91.48                        | 6.3                            | 80.05                        | — 12.60   | 6.16                            | 78.27                        |
| 224993        | Schurus carolinensis.     | Dec. 28, 1904    | do.       | do.                 | 8.25  | 8.0                           | 96.97                        | 7.06                           | 85.45                        | — 11.88   | 6.17                            | 74.78                        |
| 224987        | Microtus pennsylvanicus.  | Dec. 2, 1904     | do.       | do.                 | 9   | 7                             | 77.78                        | 6.69                           | 76.67                        | — 1.43  | .66                             | 73.83                        |
| 225111        | Antilocapra americana.    | Dec. 6, 1904     | do.       | do.                 | 180.2   | 129.2                         | 99.23                        | 121.0                          | 92.93                        | — 6.35  | 110.7                           | 85.02                        |
| 225115        | Trichosurus fuliginosus.  | Dec. 13, 1904    | do.       | do.                 | 12.27   | 12.9                          | 106.13                       | 11.07                          | 90.22                        | — 14.19   | 10.0                            | 81.50                        |
| 225120        | Dasyurus maculatus.       | Dec. 22, 1904    | do.       | do.                 | 5.35  | 5.09                          | 95.14                        | 4.67                           | 87.29                        | — 8.24  | 4.80                            | 80.37                        |
| 224986        | Corvus brachyrhynchus.    | Nov. 30, 1904    | do.       | do.                 | 8.55  | 8.2                           | 95.91                        | 7.69                           | 89.94                        | — 6.22  | 7.16                            | 83.63                        |
| 225105        | Xanthura luxiosa.         | Nov. 23, 1904    | do.       | do.                 | 2.4   | 2.1                           | 87.50                        | 2.07                           | 86.25                        | — 1.43  | 1.84                            | 76.67                        |
| 224989        | Synhiatrica pallia.       | Dec. 5, 1904     | do.       | do.                 | 1.75  | .67                           | 89.33                        | .60                            | 80.00                        | — 10.45   | .51                             | 68.00                        |
| 224990        | Mimus polyglottus.        | do.              | do.       | do.                 | 1.3   | 1.3                           | 100.00                       | 1.19                           | 91.54                        | — 8.46  | 1.07                            | 82.31                        |
| 224983        | Erithacus rubecula.       | Nov. 27, 1904    | do.       | do.                 | .9  | .6                            | 80.00                        | .51                            | 63.00                        | — 12.0  | .5                              | 66.67                        |
| 224992        | Leiothrix lutea.          | Dec. 17, 1904    | do.       | do.                 | 1.07  | .9                            | 84.11                        | .82                            | 76.63                        | — 8.89  | .76                             | 71.03                        |
| 224985        | Columbigallina.           | Nov. 29, 1904    | do.       | do.                 | 5.6   | .64                           | 90.00                        | .45                            | 75.00                        | — 16.67   | .45                             | 75.00                        |
| 224982        | Megascops asio.           | Nov. 25, 1904    | do.       | do.                 | 6.1   | 5.1                           | 91.07                        | 4.68                           | 82.67                        | — 9.22  | 4.35                            | 77.64                        |
| 224991        | Srix pratincola.          | Dec. 12, 1904    | do.       | do.                 | 8.0   | 7.15                          | 89.37                        | 6.8                            | 85.00                        | — 4.90  | 6.4                             | 80.00                        |
| 224994        | Bonasa umbellus.          | Jan. 3, 1905     | do.       | do.                 | 2.7   | 2.25                          | 83.33                        | 2.2                            | 81.48                        | — 2.22  | 2.1                             | 77.78                        |
| 224984        | Larus argentatus.         | Nov. 28, 1904    | do.       | do.                 | 7.02  | 6.4                           | 91.16                        | 6.92                           | 84.33                        | — 7.50  | 5.65                            | 80.48                        |
| 225119        | Canis dingo.              | Dec. 21, 1904    | 20 days.  | do.                 | 25.07   | 25.27                         | 100.79                       | 20.89                          | 83.32                        | — 17.88   | 19.0                            | 76.79                        |
| 225109        | do.                       | Dec. 5, 1904     | 4 days.   | do.                 | 9.55  | 8.99                          | 94.13                        | 7.32                           | 76.75                        | — 18.56   | 7.22                            | 75.60                        |
| 225108        | do.                       | do.              | do.       | do.                 | 9.25  | 8.45                          | 91.35                        | 7.19                           | 77.73                        | — 14.91   | 6.46                            | 69.84                        |
| 225107        | do.                       | do.              | do.       | do.                 | 9.44  | 9.47                          | 100.32                       | 8.06                           | 85.27                        | — 15.00   | 6.7                             | 70.98                        |

*Solution: One-half saturated solution of alum, with 10 per cent formalin—Continued.*

## AVERAGES.

| Subject.            | Per cent of original weight— |                 | Subject.            | Per cent of original weight— |                 |
|---------------------|------------------------------|-----------------|---------------------|------------------------------|-----------------|
|                     | At the end of 1 week.        | After 6 months. |                     | At the end of 1 week.        | After 6 months. |
| ADULTS.             |                              |                 |                     |                              |                 |
| Human subjects..... | (2) 101.47                   | (2) 95.45       | Human subjects..... | (4) 96.65                    | (4) 73.05       |
| Mammals.....        | (9) 96.48                    | (9) 87.04       | Mammals.....        | (4) 90.77                    | (4) 73.05       |
| Birds.....          | (11) 89.25                   | (11) 76.30      | Birds.....          |                              |                 |
| YOUNG.              |                              |                 |                     |                              |                 |

*Solution: One-third saturated solution of alum, with 5 per cent formalin.*

| Catalogue No. | Subject.                       | Date of autopsy. | Age.          | Condition of brain.           | Weight of brain immediately after removal. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and fourth week. | Weight of brain after 1 year. | Per cent of original weight. |
|---------------|--------------------------------|------------------|---------------|-------------------------------|--|-------------------------------|------------------------------|--------------------------------|------------------------------|--|-------------------------------|------------------------------|
|               |                                |                  |               |                               | Grams.                                     | Grams.                        | Grams.                       | Grams.                         | Grams.                       | Grams.   | Grams.                        | Grams.                       |
| 224753        | Negro man (full blood).....    | July 30, 1904    | 47 years..... | Pronounced serous congestion. | 1,300.0                                    | 1,366.0                       | 105.07                       |                                |                              |  | 1,229.5                       | 94.57                        |
| 224811        | Papio doguera.....             | July 5, 1904     | Adult.....    | Medium.....                   | 182.0                                      | 171.5                         | 94.23                        | 152.5                          | 83.79                        | -11.08   | 144.0                         | 79.12                        |
| 224803        | Papio hamadryas.....           | Aug. 1, 1904     | do.....       | do.....                       | 142.0                                      | 148.6                         | 104.64                       | 133.6                          | 94.06                        | -10.10   | 122.0                         | 85.92                        |
| 224830        | Cynopithecus niger.....        | June 27, 1904    | do.....       | do.....                       | 110.0                                      | 115.0                         | 104.54                       | 96.2                           | 87.45                        | -16.35   | 88.5                          | 80.45                        |
| 224745        | Papio cynocephalus.....        | Apr. 21, 1904    | do.....       | do.....                       | 162.0                                      | 159.5                         | 98.46                        | 141.0                          | 87.04                        | -11.60   | 125.0                         | 77.16                        |
| 224799        | Ateles Geoffroyi.....          | June 2, 1904     | do.....       | do.....                       | 91.0                                       | 90.05                         | 98.90                        | 78.0                           | 86.71                        | -13.38   | 71.5                          | 78.57                        |
| 224806        | Cercopithecus fuliginosus..... | June 27, 1904    | do.....       | do.....                       | 112.0                                      | 111.0                         | 99.10                        | 94.0                           | 83.83                        | -15.32   | 85.5                          | 76.34                        |
| 224812        | Cebus hypoleucus.....          | July 6, 1904     | do.....       | do.....                       | 75.0                                       | 66.8                          | 89.06                        | 59.3                           | 79.06                        | -11.23   | 56.5                          | 75.32                        |
| 224807        | Lemur varius.....              | June 27, 1904    | do.....       | do.....                       | 34.5                                       | 32.7                          | 94.78                        | 30.8                           | 89.27                        | -6.81  | 29.0                          | 84.76                        |
| 224797        | Ermacacus europaeus.....       | June 16, 1904    | do.....       | do.....                       | 8.23                                       | 8.12                          | 96.59                        | 8.0                            | 92.87                        | -3.85  | 2.9                           | 89.76                        |
| 224798        | Mephitis mephitis.....         | do.....          | do.....       | do.....                       | 6.52                                       | 6.16                          | 94.48                        | 5.85                           | 85.58                        | -5.04  | 5.55                          | 85.13                        |
| 224831        | Helarctos malayanus.....       | Apr. 21, 1904    | do.....       | do.....                       | 385.5                                      | 391.0                         | 101.43                       | 399.0                          | 86.72                        | -5.63  | 35.8                          | 83.84                        |
| 224804        | Vulpes pribelofensis.....      | June 20, 1904    | do.....       | do.....                       | 42.7                                       | 42.7                          | 100.0                        | 38.0                           | 88.99                        | -11.2  | 137.0                         | 88.96                        |
| 224810        | Felis concolor.....            | July 5, 1904     | do.....       | do.....                       | 154.0                                      | 125.0                         | 81.16                        | 138.9                          | 90.19                        | +11.2  | 137.0                         | 88.96                        |
| 224855        | do.....                        | June 13, 1905    | do.....       | do.....                       | 137.5                                      | 141.0                         | 102.62                       | 144.0                          | 104.72                       | +2.13  | 118.5                         | 86.13                        |



## PART II.

### PHYSICAL CHANGES IN SHEEP BRAINS COLLECTED AND PRESERVED UNDER SIMILAR CONDITIONS IN VARIOUS FORMALIN PREPARATIONS.

The first part of this paper dealt with the effects of formalin preservatives on the weight of human, other mammal, and bird brains, adult as well as young, collected under various conditions. The results in any solution, although more or less characteristic for that particular liquid, were by no means uniform. It was found that, in general, the changes in the large brains were less than in the small ones, and those in the adult less than in the young. Some of the differences may eventually be found to be those of species or larger subdivisions of the animal kingdom; but beyond all this there was seen a considerable and unaccountable variation. This element was recognized long before the first experiments were completed. It rendered desirable a separate series of observations on the brains of some fair-sized animal, collected equally fresh, extracted and subsequently treated in the same manner, and kept in proportionately the same quantities of the preservative. Under such conditions the action of the various preservatives should be much clearer and more comparable, and the differences in the changes be reduced to the minimum; if noticeable disagreements still existed, they would point to differences in the structure of the brains or in their chemical composition.

It became possible to undertake the series of experiments during the early part of the summer just past. An arrangement was made with one of the city butchers to deliver every morning a small series of heads of sheep killed the night preceding. The brains, with the help of the laboratory aid, Mr. Docekal, were extracted in as short a time as possible and in the same manner (see Part I), then weighed and placed in a proportioned quantity of the preservative. Fifteen series were determined upon and the specimens were secured in a little over two weeks, during quite uniformly warm weather. Every series except two, which were smaller, consisted of eleven brains. Ten of the specimens were placed in a quantity of the preservative amounting to 3 c. c. for each gram weight of the specimen, while with one the quantity to the gram was made 6 c. c. Of the brains in 3 c. c. to the gram liquid, one of about average dimension was weighed every day the same hour, while the remaining nine and also the eleventh specimen were weighed at the end of seven and again at the end of

thirty days. Other weighings, as indicated in the detail tables, were taken thereafter. At the end of the seventh and the thirtieth day the solution and cotton were changed, as is done with all specimens in the museum collection. The drainage of each specimen was as uniform as practicable by the method outlined in the first part of this paper.

The solutions employed were:

1. Three per cent formalin.
2. Five per cent formalin.
3. Ten per cent formalin.
4. Fifteen per cent formalin.
5. Saturated solution of common salt with 5 per cent formalin.
6. 1,030 sp. gr. common salt solution with 5 per cent formalin.
7. 1,015 sp. gr. common salt solution with 5 per cent formalin.
8. Saturated solution of alum with 5 per cent formalin.
9. One-third saturated solution of alum with 5 per cent formalin.
10. One-fifth saturated solution of alum with 5 per cent formalin.
11. One-third saturated solution of alum with common salt up to sp. gr. 1,030, with 10 per cent formalin.
12. Saturated solution of alum with 5 per cent formalin.
13. Eighty parts of 95 per cent alcohol and 20 parts of 5 per cent formalin.
14. Sixty-five parts of 95 per cent alcohol and 35 parts of 3 per cent formalin (near that of Parker & Floyd).
15. Sodium acetate 130 grams, sodium chloride 110 grams, formalin 20 c. c., 95 per cent, alcohol 460 c. c., water 540 c. c. (Stroud, Wilder).

The results, in detail, were as follows:

#### THREE PER CENT FORMALIN.

End of first week: The weight of brains in the 3 c. c. to the gram solution had risen in average 21 per cent, or over one-fifth of the original. Variation: From 118.55 per cent (specimen of 102 grams original weight) to 123.9 per cent (specimen of 102.5 grams)=5.37 per cent. The two heaviest brains (117.5 and 110.5 grams) gained, respectively, 20 and 18.55 per cent in weight, the two lightest ones (94 and 93.2 grams) 20.2 and 22.1 per cent. The brain in the 6 c. c. to the gram solution (100.5 grams original weight) increased 18.9 per cent, less than any other except one of the heaviest specimens, and the one weighed every day, which may have been affected thereby.

End of first month: Weight of five of the nine brains in the 3 c. c. to the gram solution is very slightly greater (+0.08 to +0.44 per cent); of three, slightly smaller (-0.42 to -1.15 per cent), and of one, equal. Variation: From 117.19 to 124.02 per cent<sup>a</sup>=6.8 per cent. The changes were not quite harmonious with those of the first week, or proportionate to the weight of the specimens. The brain in the 6

<sup>a</sup> As compared with original weight.

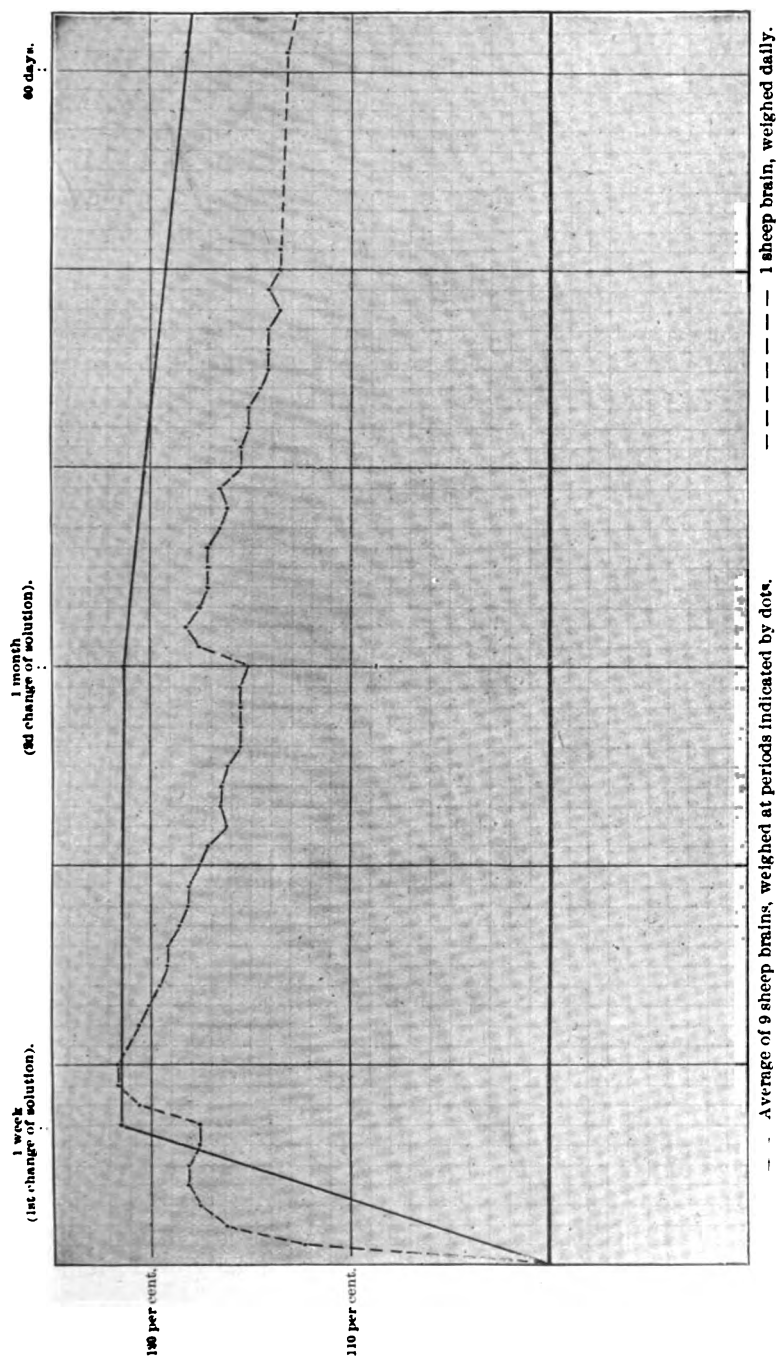


FIG. 12.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 3 PER CENT FORMALIN SOLUTION.

c. c. to the gram solution lost most and is now relatively the lightest of the whole series, excepting the one weighed every day.

The brain weighed daily showed a great gain during the first day, reached maximum on the fifth, and began to decline on the seventh; after change of solution it rose during two days, and then again began to lose, which was repeated identically after the one-month change.

#### FIVE PER CENT FORMALIN.

End of first week: Weight of brains in 3 c. c. to the gram solution had risen in average 17.9 per cent, or a little over one-sixth of the original. Variation: From 116.12 (specimen of 119.7 grams original weight) to 120 per cent (specimen of 99 grams original weight)=3.88 per cent. The two heaviest brains (119.7 and 117 grams) gained, respectively, 16.1 and 18.4 per cent in weight, the two lightest ones (98.5 and 95.5 grams) 17.8 and 19.4 per cent. The brain in the 6 c. c. to the gram solution (100.5 grams original weight) had risen 18.9 per cent; that weighed every day 17.8 per cent.

End of first month: Only one specimen showed a slight gain (+1.08 per cent), while in eight there was a loss (−0.36 to −2.39 per cent). Variation: From 113.87 to 119.66 per cent=5.79 per cent. The changes were not quite harmonious with those of the first week, or proportionate to the weight of the specimen. The brain in the 6 c. c. to the gram solution lost 2.09 per cent, that weighed daily 2.39 per cent of weight, both above the average.

The brain weighed daily gained much on the first day, reached a maximum on the fourth day, declined slowly to seventh, rose after change of solution during two days, fell gradually to the end of the first month, then, after a change of solution, rose one day and has been slowly losing since.

#### TEN PER CENT FORMALIN.

End of first week: Weight of brains in 3 c. c. to the gram solution had risen in average 15 per cent, or nearly one-seventh of the original. Variation: From 112.84 (original weight, 97.5 grams) to 116.87 per cent (original weight, 80 grams)=4.03 per cent. The two heaviest brains (112 and 110.5 grams) gained, respectively, 14.73 and 15.38 per cent, the two lightest (96.5 and 80 grams) 15.54 and 16.87 per cent. The brain in the 6 c. c. to the gram solution (125 grams original weight) gained but 14 per cent of weight, that weighed daily (102 grams original weight) 16.17 per cent.

End of first month: The weight of one of the nine specimens in 3 c. c. to the gram solution has very slightly (+0.45 per cent) increased, that of the other eight slightly to moderately (−1.07 to −3.29 per cent) decreased. Variation: From 110.31 to 115.63 per cent=5.32 per cent. The changes did not quite harmonize with those of the first

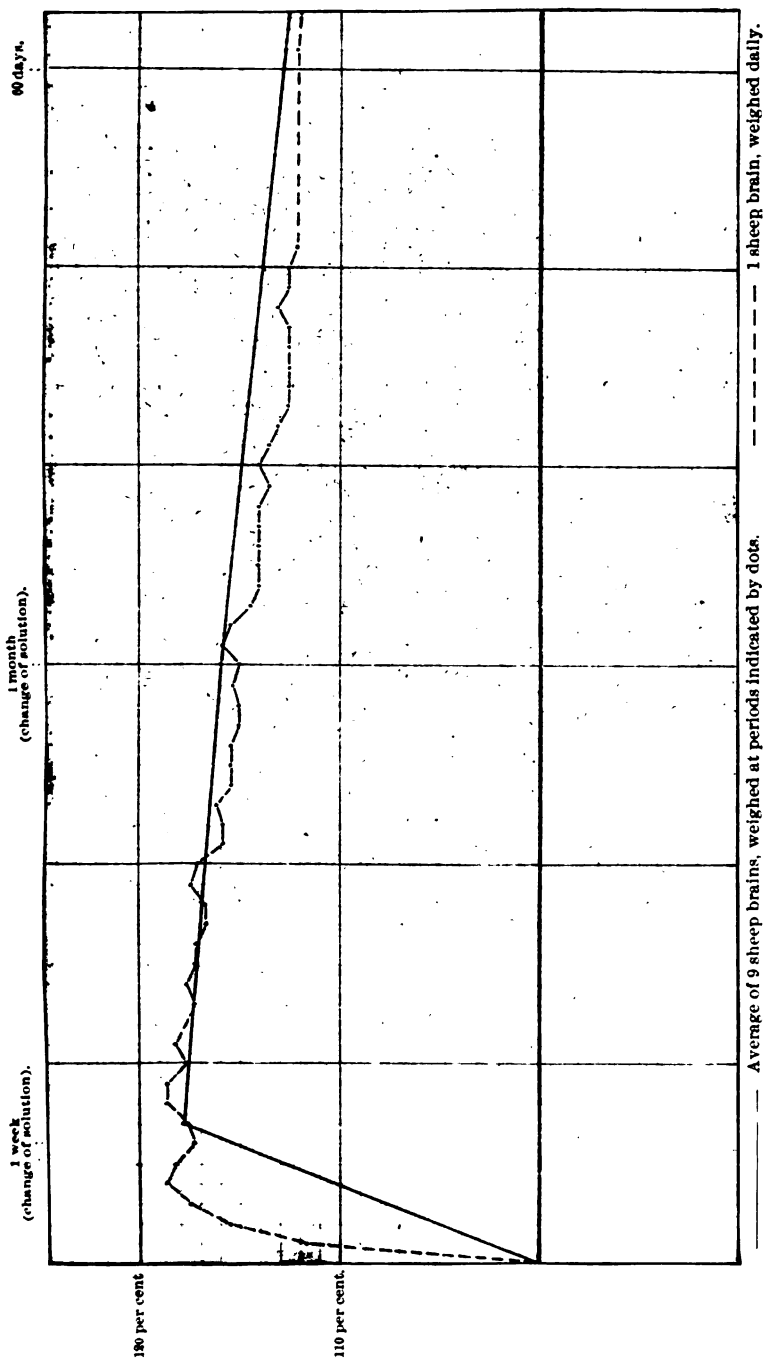
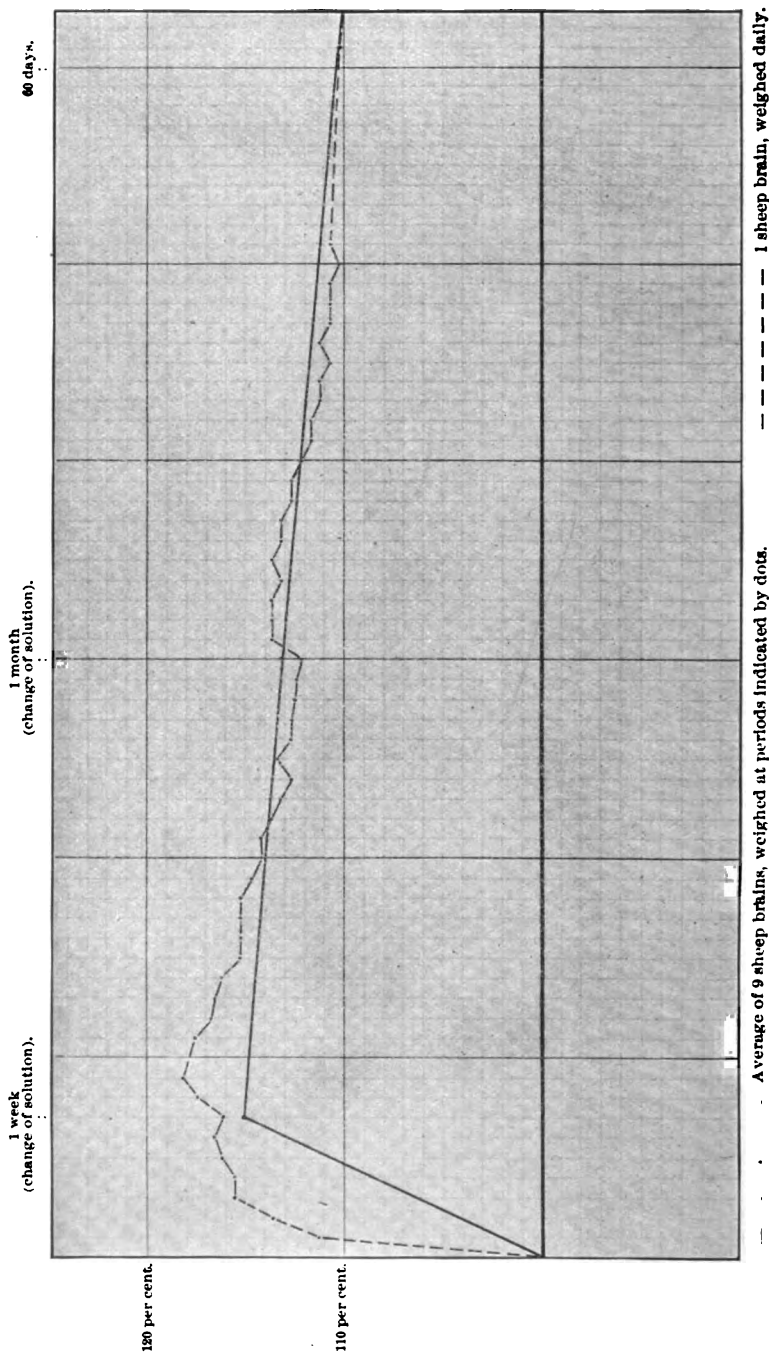


FIG. 13.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 5 PER CENT FORMALIN SOLUTION.



Average of 9 sheep brains, weighed at periods indicated by dots.

FIG. 14.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 10 PER CENT FORMALIN SOLUTION.

week nor were they proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost 1.05 per cent in weight, that weighed daily 3.38 per cent.

Changes in the brain weighed every day: Considerable rise the first twenty-four hours, continuation of rise until the sixth day, then slow decline; a moderate rise of two days' duration after the first and of one day after the second change of solution.

#### FIFTEEN PER CENT FORMALIN.

End of first week: Weight of specimens in 3 c. c. to the gram solution had risen in average nearly 13 per cent, or one-eighth of the original. Variation: From 107.61 (original weight, 98.5 grams) to 116.48 per cent (original weight, 91 grams)=8.87 per cent. The two heaviest brains (119 and 111.8 grams) gained, respectively, 12.1 and 13.5 per cent, the two lightest ones (94 and 91 grams) 11.7 and 16.4 per cent. The brain in the 6 c. c. to the gram liquid (original weight, 97 grams) gained but 9.08 per cent, less than any of the above with one exception, that weighed daily (original weight, 105.5 grams) gained but 8.53 per cent.

End of first month: Weight of all the nine specimens in 3 c. c. to the gram solution has diminished (—0.88 to 2.31 per cent). Variation: From 105.58 to 115.38 per cent=9.8 per cent. The changes are fairly harmonious with those of the first week, but are not proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost 5.95 per cent, much more than any of the above, that weighed daily 3.49 per cent, also more than any of those in similar quantity of solution but weighed less frequently.

Changes in the brain weighed daily: A moderate rise in weight during the first twenty-four hours, maximum of rise on fourth day, then slow, continuing loss; one day's rise after each change of solution.

#### SATURATED SOLUTION OF SODIUM CHLORIDE, WITH 5 PER CENT FORMALIN.

End of first week: Weight of brains in the 3 c. c. to the gram solution had diminished in average by 7 per cent, or one-fourteenth of the original. Variation: From 90.33 (original weight, 95.2 grams) to 95.19 per cent (original weight, 104 grams)=4.86 per cent. The two heaviest brains (107.7 and 105 grams) lost, respectively, 6.6 and 5.72 per cent; the two lightest (89.7 and 84.5 grams) 5.8 and 5.9 per cent. The specimen in the 6 c. c. to the gram solution (original weight, 95.5 grams) lost 6.8 per cent, that weighed every day 7.9 per cent.

End of first month: Weight of all nine brains in the 3 c. c. to the gram solution decreased (—3.15 to 5.23 per cent). Variation: From 85.61 to 91.82 per cent=6.2 per cent. The decrease was quite alike in most of the nine specimens and harmonized somewhat with that of

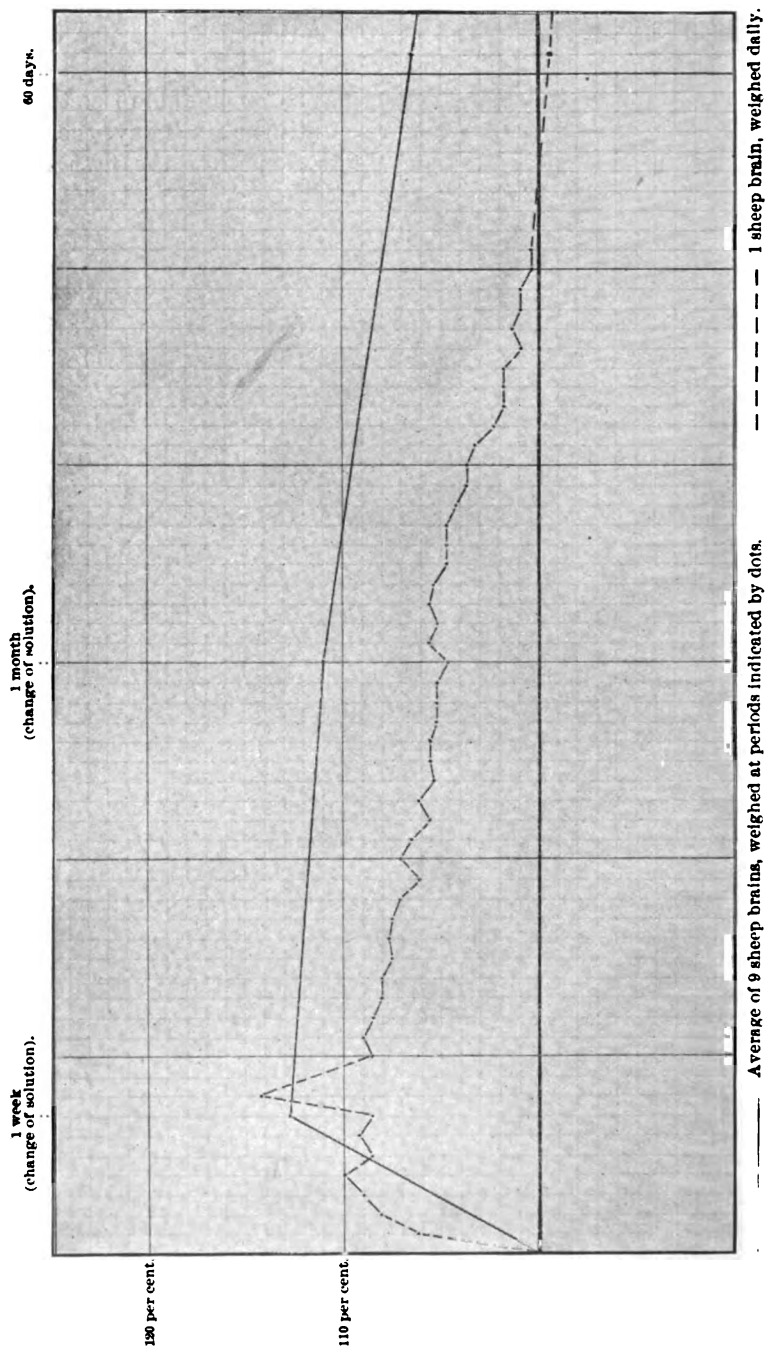


FIG. 16.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 15 PER CENT FORMALIN SOLUTION.

the first week, but was not proportionate to the original weight. The brain in the 6 c. c. to the gram solution fell to 90.05 per cent of original weight; after which it diminished until it became relatively the lightest of all; that weighed every day was damaged and discarded at first change.

1,030 SPECIFIC GRAVITY SODIUM CHLORIDE SOLUTION WITH 5 PER CENT FORMALIN.

End of first week: Two of the nine brains in the 3 c. c. to the gram solution showed a slight increase, seven a slight decrease, in weight. Variation: From 93.86 (original weight, 106 grams) to 104.2 per cent (original weight, 107 grams)=10.34 per cent. The two heaviest brains (112 and 107 grams) gained, respectively, 2.68 and 4.2 per cent, the two lightest (95 and 94 grams) lost 1.58 and 3.73 per cent in weight. The brain in the 6 c. c. to the gram solution (original weight, 105 grams) lost 5.72 per cent, more than any of the above but one, and that weighed every day (original weight, 103 grams), lost 2.92 per cent in weight.

End of first month: All the brains in the 3 c. c. to the gram solution lost slightly in weight after the end of the first week (−1.3 to −3.72 per cent), but two are still slightly heavier than originally. Variation: From 92.45 to 102.33 per cent=9.88 per cent. The changes were not wholly harmonious with those during the first week, or proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost more than any but two of the above (2.02 per cent) and is now relatively the lightest; that weighed every day lost 3 per cent and is now also among the relatively lightest specimens.

Changes in the brain weighed daily: The first day a very slight loss of weight, which continued slowly till the first change (the first day after which there was an insignificant gain) and then up to the one month change (which produced no result). After the thirty-fifth day there were two weeks of stability, with a slight loss following.

1,015 SPECIFIC GRAVITY SODIUM CHLORIDE SOLUTION WITH 5 PER CENT FORMALIN.

End of first week: Weight of brains in 3 c. c. to the gram solution had risen in average a little less than 2 per cent, or a little less than one-fiftieth of the original. Variation: From 101.29 (original weight, 116 grams) to 102.45 per cent (original weight, 102 grams)=1.2 per cent. The brain in 6 c. c. to the gram solution, (123 grams original weight) rose 2.03 per cent; that weighed daily (11.4 grams original weight) 1.31 per cent.

End of first month: Weight of both specimens in 3 c. c. to the gram solution has diminished (−1.43 per cent and −1.7 per cent). Variation=1.41 per cent. The specimen in 6 c.c. to the gram solution

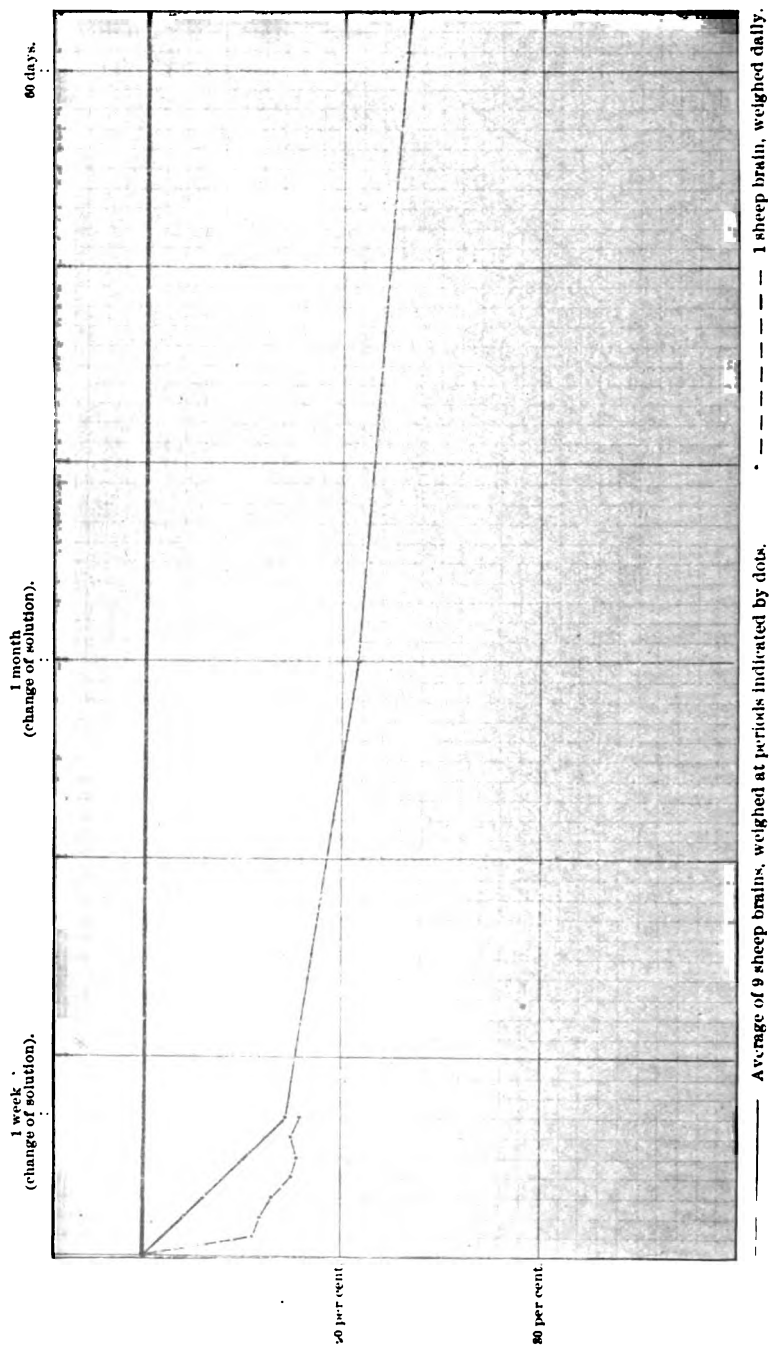


FIG. 16.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SATURATED SOLUTION OF SODIUM CHLORIDE WITH 5 PER CENT FORMALIN.

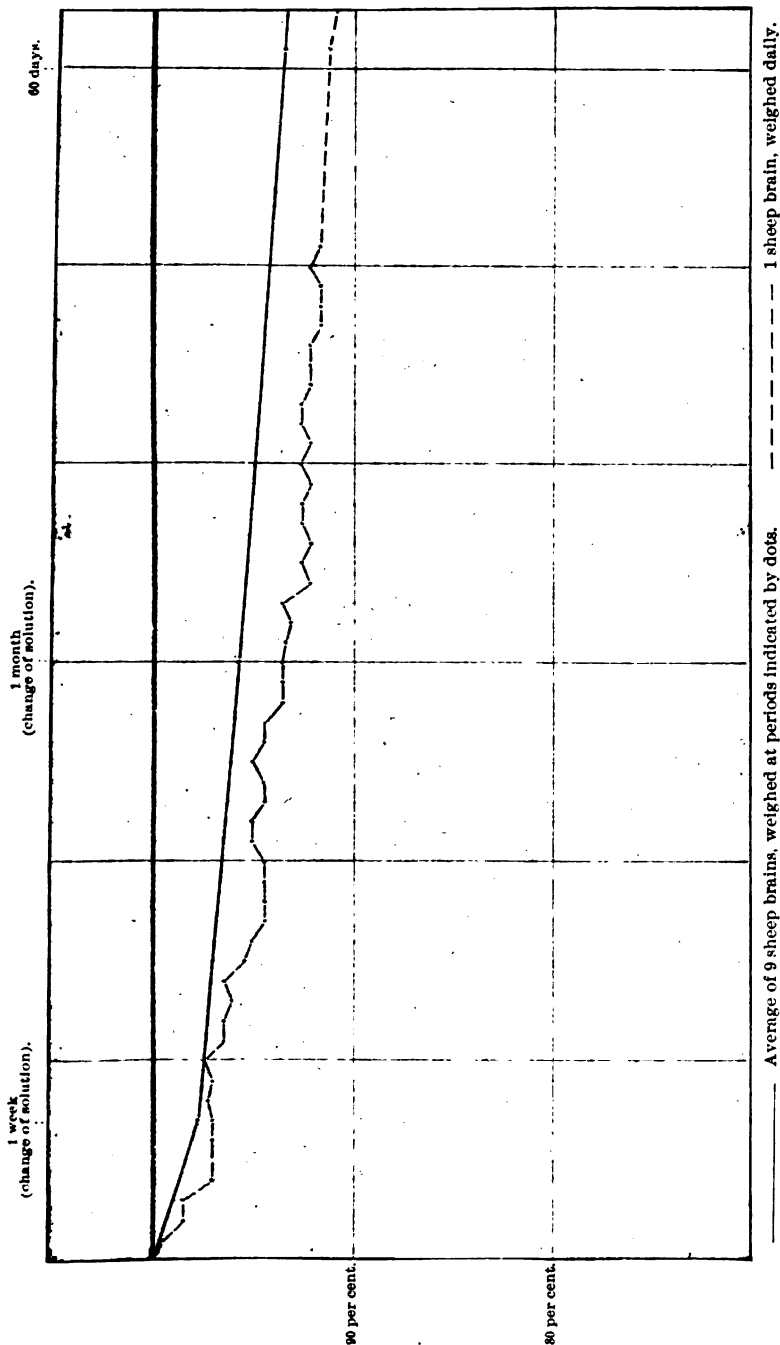


FIG. 17.—(CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN 1.030 SPECIFIC GRAVITY FORMALIN SALT SOLUTION.

(original weight, 123 grams) lost 2.39 per cent in weight, more than either of the above; while that weighed daily (original weight, 114 grams) lost even more, or exactly 3.03 per cent.

The brain weighed daily fell very slightly in weight during the first day, rose slightly during the next two days (reaching maximum the third day), remained stationary the fourth day and then began to lose. It rose the first day after a change of solution, remained one day stationary, and then lost slightly, gained again a little, and then continued to lose to the end of the first month. No rise followed the one month change, the specimen remaining stationary in weight for one day, and then went on losing.

#### SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

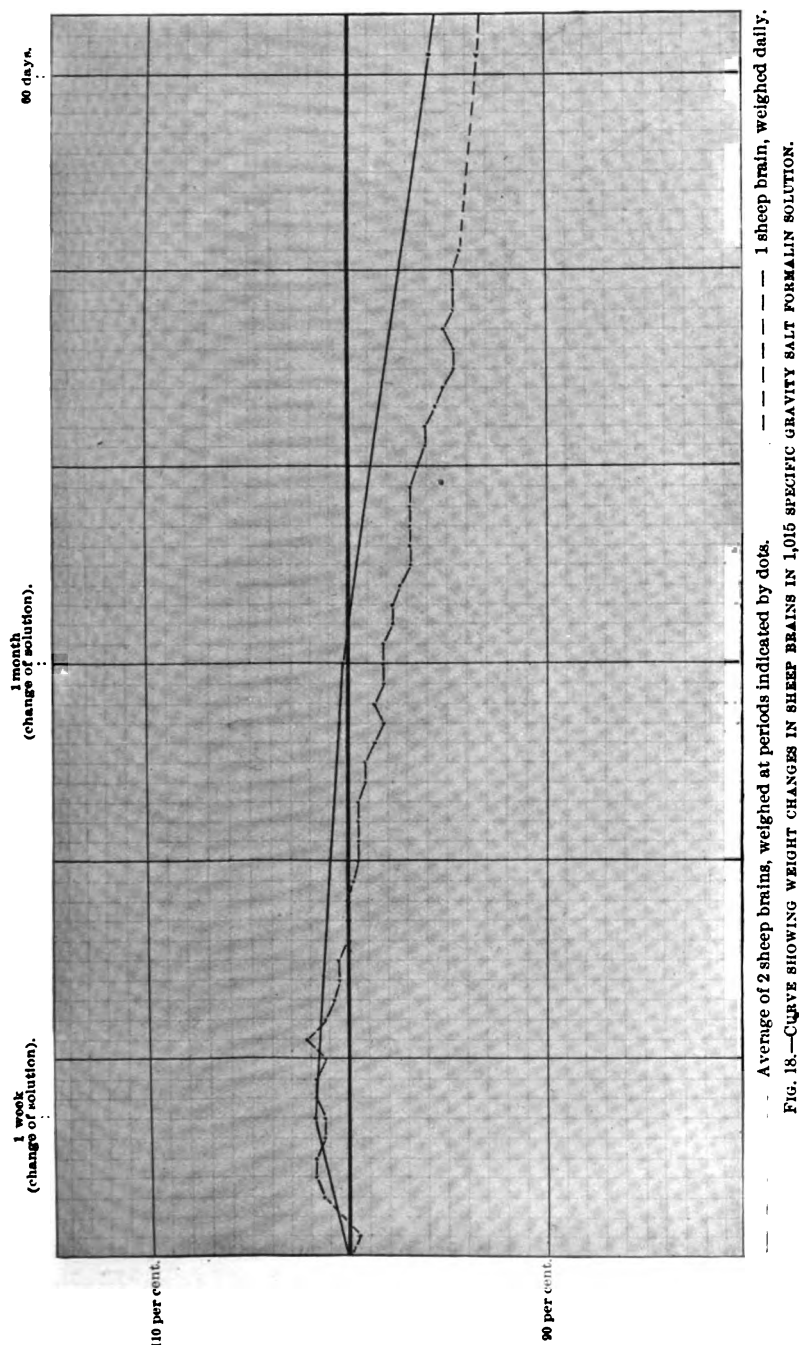
End of first week: Weight of brains in 3 c. c. to the gram solution had fallen in average nearly 23 per cent, or nearly one-fourth of the original. Variation: From 74.27 (original weight 103 grams) to 81.74 per cent (original weight 115 grams) = 7.47 per cent. The two heaviest brains (115 and 109.7 grams) lost, respectively, 18.26 and 23.25 per cent in weight, the two lightest ones (92 and 88 grams) 21.74 and 23.87 per cent. The brain in the 6 c. c. to the gram solution (original weight 125.2 grams), the largest specimen in the series, lost but 17.74 per cent, hence less than any other; that weighed every day (original weight 101 grams) lost 25.75 per cent, which is more than any of the remaining nine in same solution.

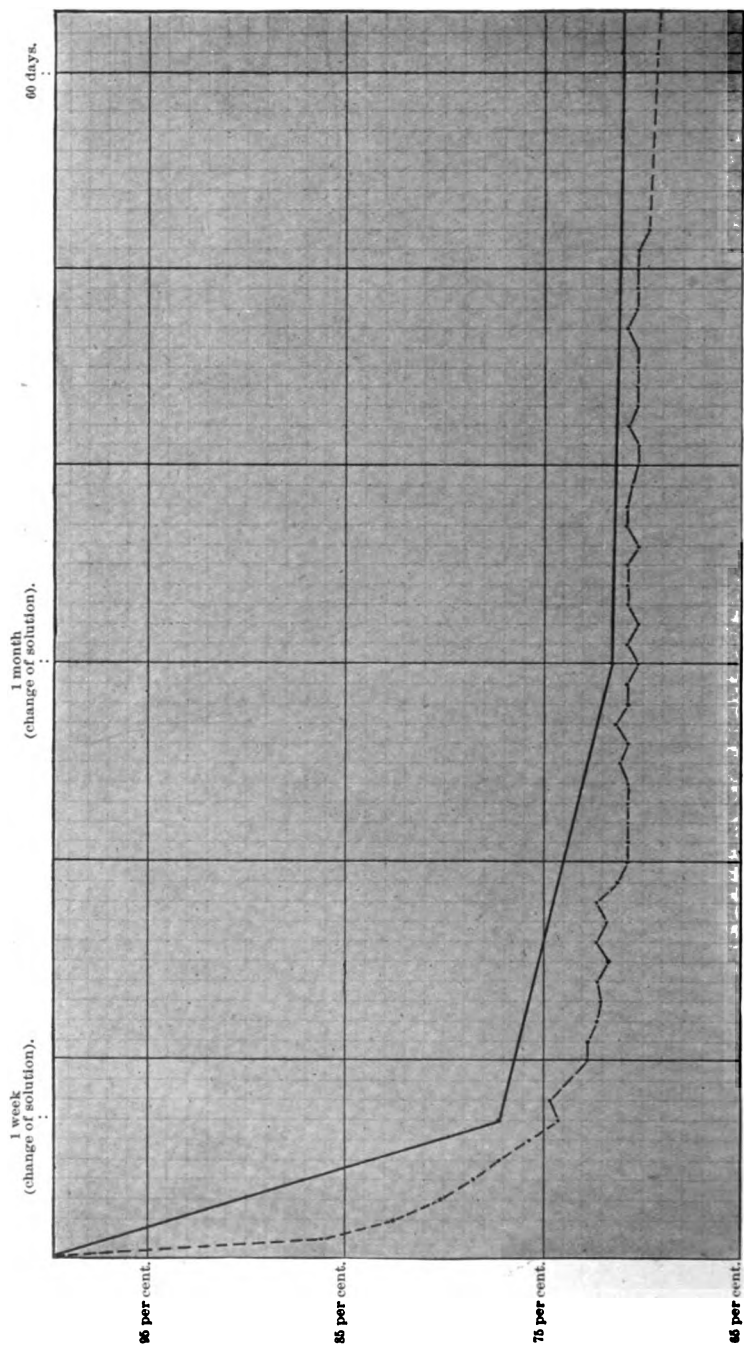
End of one month: All of the brains in the 3 c. c. to the gram liquid had suffered noticeably further loss, and that from 4.86 to 9.04 per cent. Variation: From 64.08 to 74.45 per cent = 10.37 per cent. The changes were not harmonious with those of the first week nor proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution, though large, lost considerable (10.68 per cent); and that weighed every day became relatively lightest but one of all those in the 3 c. c. to the gram solution.

The brain weighed every day showed a great loss during the first twenty-four hours, lost slowly and steadily for eighteen days, remained nearly stationary during next thirty days, and then lost slightly again. The day after each change of solution an insignificant rise took place.

#### ONE-THIRD SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

End of first week: Four of the nine brains in the 3 c. c. to the gram solution showed a very slight increase (+0.42 to +0.90 per cent), five a slight decrease (-1.43 to -2.59 per cent). Variation: From 97.41 (original weight 116 grams) to 100.9 per cent (original weight 110 grams) = 3.49 per cent. The two heaviest brains (120 and 116.5 grams) showed, respectively, 100.42 and 97.85 per cent; the two lightest ones





— Average of 9 sheep brains, weighed at periods indicated by dots. — 1 sheep brain, weighed daily.  
 FIG. 19.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SATURATED SOLUTION OF ALUM WITH 5 PER CENT OF FORMALIN.

(103 and 97 grams), 98.54 and 100.51 per cent of their original weight. (There is no relation apparent at this stage between the changes and weight of the specimens, but ultimately the originally heaviest brain showed, with one exception only, the least loss, the lightest brain the greatest loss. The specimen in the 6 c. c. to the gram solution (original weight 122 grams) lost 2.05 per cent, with two slight exceptions, more than any of the above; that weighed daily (original weight 108 grams) losing 4.17 per cent, or more than any other specimen in the whole series.

End of first month: The weight of the specimens in 3 c. c. to the gram solution had diminished from 4.15 to 11.27 per cent (the heaviest brain losing least, the lightest most). Variation: From 89.17 to 96.25 per cent = 7.08 per cent. The changes were not harmonious with those of the first week nor proportionate to the original weight of the brains. The specimen in the 6 c. c. to the gram solution lost 5.44 per cent more than the majority of the above, that weighed daily 11.11 per cent more than any but one in the whole series.

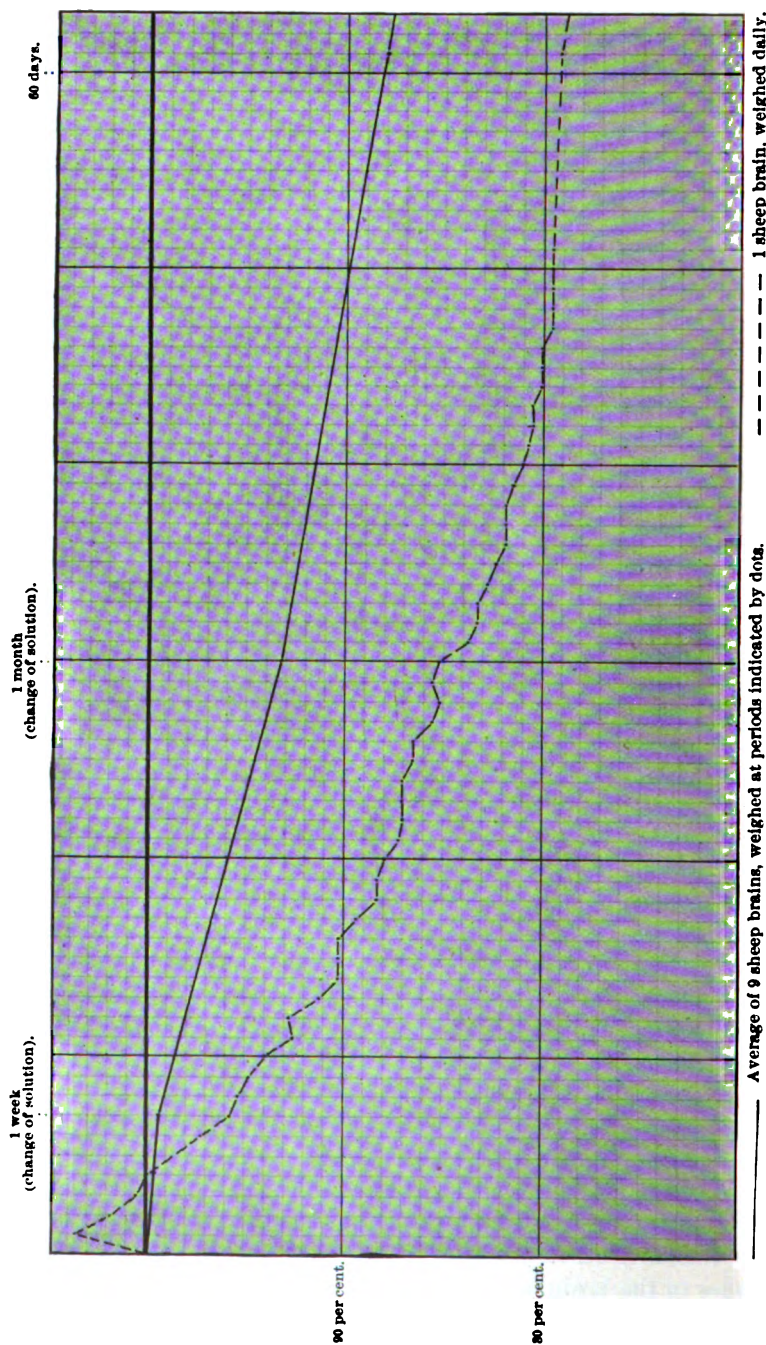
Changes in the brain weighed every day: A slight increase in weight the first twenty-four hours, followed by gradual, steady decrease, apparently not affected by either of the changes of solution.

#### ONE-FIFTH SATURATED SOLUTION OF ALUM WITH 5 PER CENT FORMALIN.

End of first week: Weight of one of the nine brains in the 3 c. c. to the gram solution had very slightly decreased, of one it was the same as original, and it had slightly increased (0.43 to 3.12 per cent) with the seven remaining. Variation: From 99.09 (original weight 109.5 grams) to 103.12 per cent (original weight 96 grams) = 4.03 per cent. The two heaviest brains (116 and 115 grams) had gained in weight, respectively, 0.43 and 0.87 per cent, the two lightest (99 and 96 grams) 3.03 and 3.12 per cent. The brain in the 6 c. c. to the gram solution (original weight 126 grams) had lost 1.59 per cent, or more than any of the above, while that weighed daily (original weight 100.2 grams) gained 1.99 per cent.

End of first month: All of the nine brains of the first group had lost in weight (7.35 to 12.83 per cent). Variation: From 87.56 to 95.45 per cent = 7.89 per cent. The changes, while not differing greatly, were not harmonious with those of the first week nor proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost in weight 7.66 per cent, that weighed daily 9.76 per cent, or more than any other in the whole series.

Changes in the brain weighed daily: A moderate increase, reaching maximum on the third day, and then a slow continuous loss, not affected by the changes of solution.



— Average of 9 sheep brains, weighed at periods indicated by dots.

--- 1 sheep brain, weighed daily.

FIG. 20.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH 5 PER CENT OF FORMALIN.

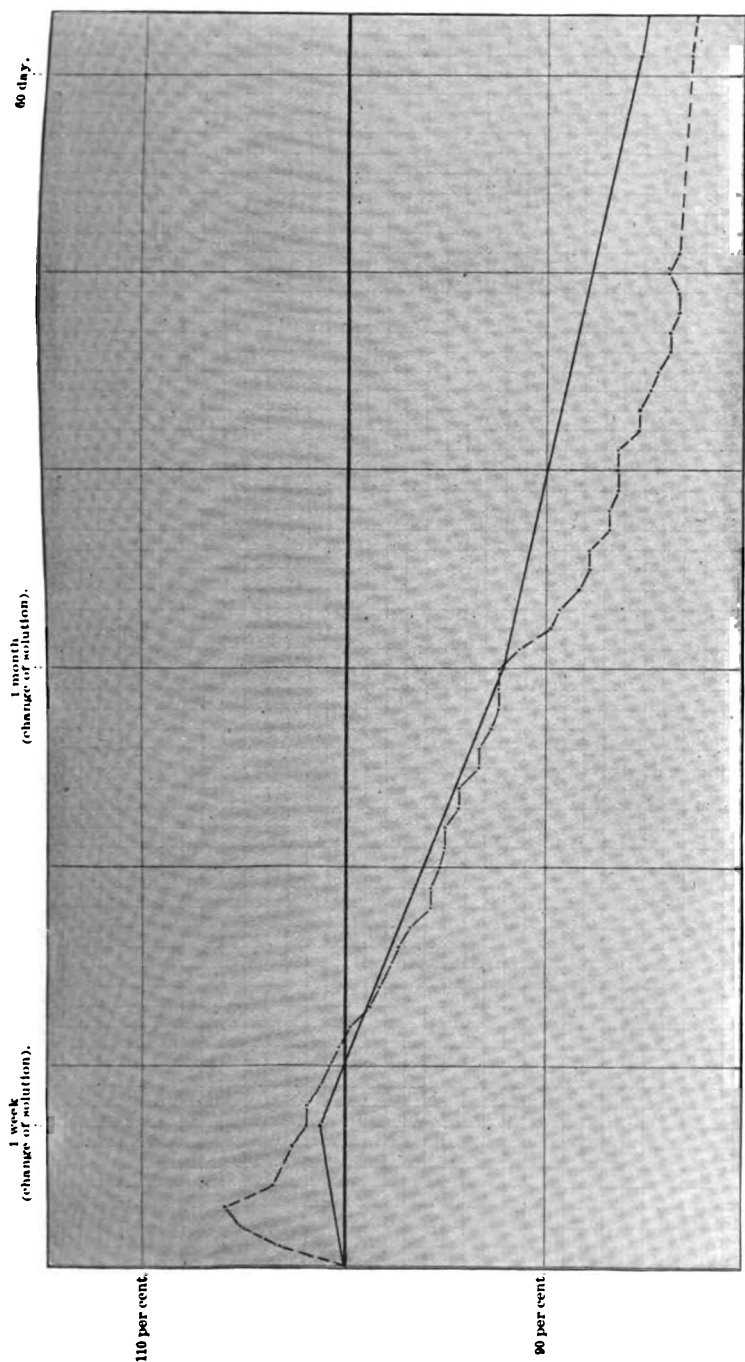


Fig. 21.—Average of 9 sheep brains, weighed at periods indicated by dots. ——— 1 sheep brain, weighed daily. --- CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-FIFTH SATURATED SOLUTION OF ALUM WITH 5 PER CENT OF FORMALIN.

ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE  
TO 1,030 SPECIFIC GRAVITY, AND 10 PER CENT FORMALIN.

End of first week: The brains in the group of nine in the 3 c.c. to the gram solution all lost moderately in weight ( $-2.99$  to  $-9.74$  per cent). Variation: From  $90.26$  (original weight  $113$  grams) to  $97.01$  per cent (original weight  $100.5$  grams)  $= 6.75$  per cent. The two heaviest brains ( $115.2$  and  $113$  grams) lost in weight, respectively,  $7.99$  and  $9.74$  per cent, the two lightest ( $100.5$  and  $95.5$  grams)  $2.99$  and  $5.24$  per cent. Ultimately, however, the heaviest brain shows the least loss, while that of the lightest specimen is among the greatest losses. The specimen in the 6 c. c. to the gram solution (original weight  $115.5$  grams) lost  $6.06$  per cent; that weighed daily, however (original weight  $105$  grams),  $10.95$  per cent, or more than any other in the series.

End of the first month: The brains in the 3 c. c. to the gram solution all show a further marked loss of weight ( $-6.6$  to  $-13.81$  per cent); the heaviest brain had lost the least, the lightest the most. Variation: From  $78.70$  to  $85.94$  per cent  $= 7.24$  per cent. Changes were not harmonious with those of the first week, and were more in a reverse than a direct proportion to the original weight of the specimens. The brain in the 6 c. c. to the gram solution lost  $11.52$  per cent, that weighed daily  $11.76$  per cent.

Changes in the brain weighed daily: A moderate loss the first and second day and gradual loss, unaffected by the changes of solution, thence onward.

ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE  
TO 1,030 SPECIFIC GRAVITY, AND 5 PER CENT FORMALIN.

End of first week: Weight of brains in the 3 c. c. to the gram solution had risen slightly ( $+0.44$  to  $+4.08$  per cent). Variation: From  $100.44$  (original weight  $114$  grams) to  $104.08$  per cent (original weight  $98$  grams)  $= 3.64$  per cent. The two heaviest brains ( $123$  and  $114$  grams) had gained, respectively,  $4.06$  and  $0.44$  per cent, the two lightest ( $98$  and  $97.5$  grams)  $4.08$  and  $3.58$  per cent. The brain in the 6 c. c. to the gram solution lost  $1.66$  per cent, that weighed daily  $4.63$  per cent.

End of first month: Weight of all brains had notably diminished ( $-13.67$  to  $-21.12$  per cent in the group of nine). Variation: From  $81.72$  to  $89.84$  per cent  $= 8.12$  per cent. The changes were not proportionate to the weight of the specimens. The brain in the 6 c. c. to the gram solution lost in weight  $10.13$  per cent, less than any of the above, and that weighed daily  $9.22$  per cent, or still less than the preceding, which compensated with both specimens for the loss during the first week.

Changes in the brain weighed daily: A slow loss from the first day onward, accelerated slightly the day after each change of solution.

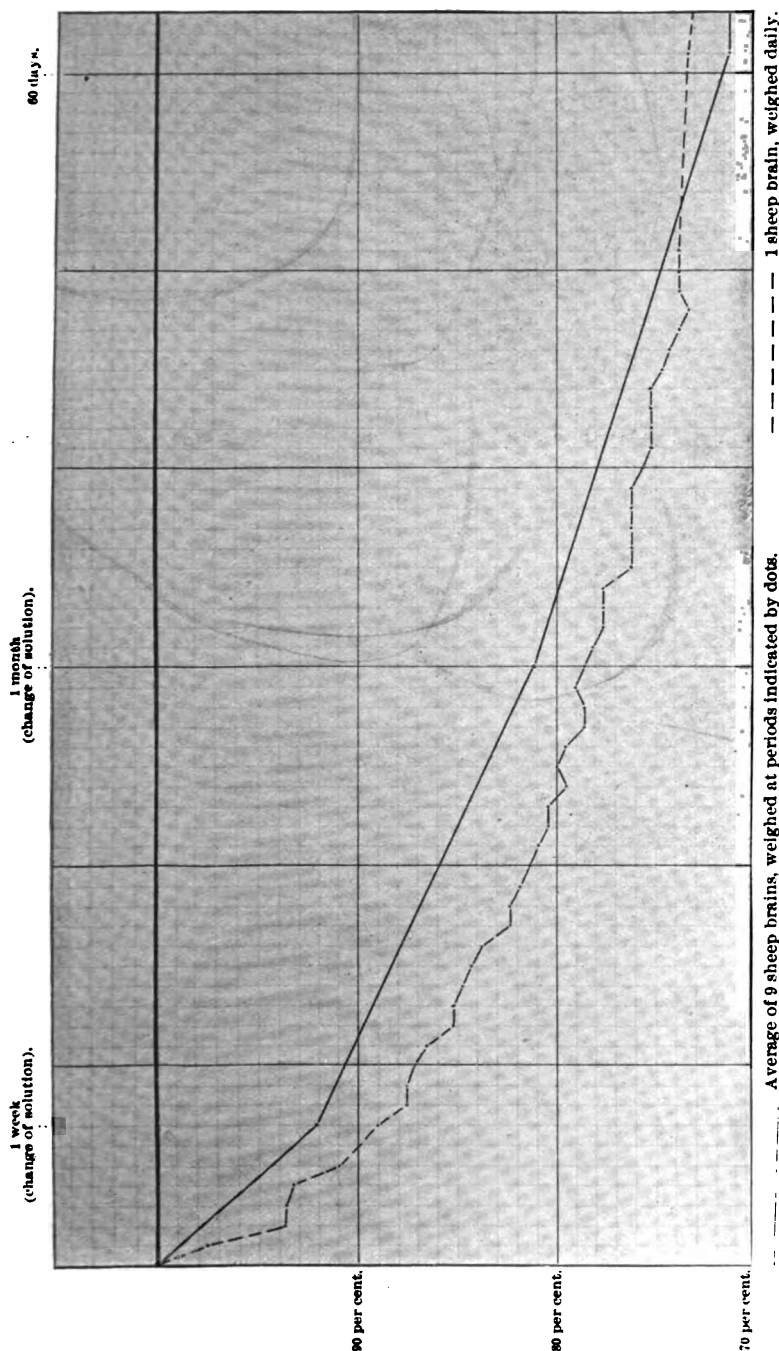


FIG. 22.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE TO 1,080 SPECIFIC GRAVITY, AND 10 PER CENT FORMALIN.

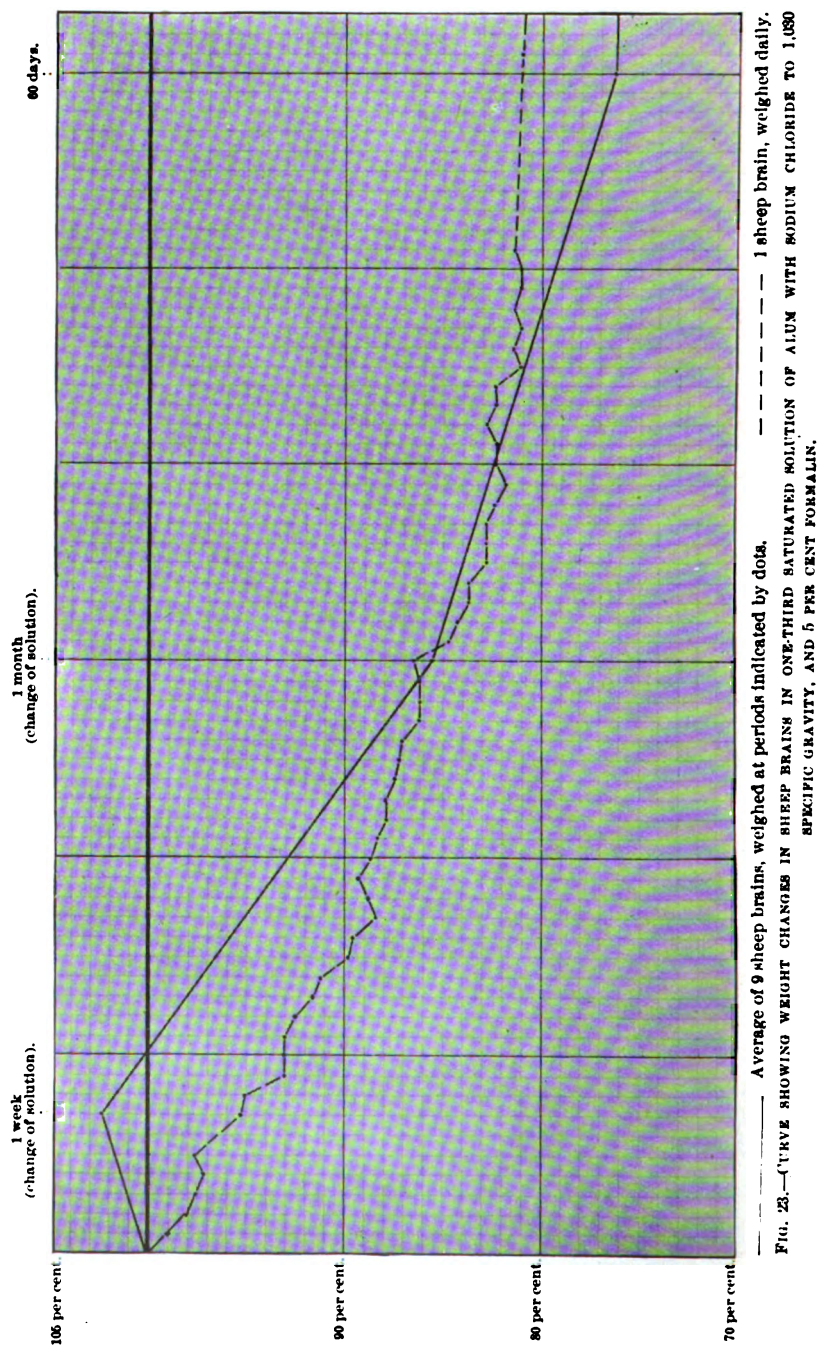


FIG. 23.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN ONE-THIRD SATURATED SOLUTION OF ALUM WITH SODIUM CHLORIDE TO 1,080 SPECIFIC GRAVITY, AND 5 PER CENT FORMALIN.

## EIGHTY PARTS OF 95 PER CENT ALCOHOL AND 20 PARTS 5 PER CENT SOLUTION OF FORMALIN.

(Alcohol, 80; water, 19; formalin, 1.)

End of first week: All the brains in the 3 c. c. to the gram solution had lost in weight; the average loss was 11.5 per cent, or one-ninth of the original. Variation: From 85.27 (original weight 112 grams) to 91.45 per cent (original weight 117 grams). The heaviest brain lost least. The specimen in the 6 c. c. to the gram solution (original weight 106 grams) lost more than any of the above (15.1 per cent), that weighed daily (original weight 109 grams) lost 11.47 per cent.

End of one month: The solution was not changed at the end of the first week nor at the end of the first month, except with the specimen weighed daily. No especial difference appeared in the results. All the brains in the 3 c. c. to the gram solution lost slightly in weight after the end of the first week ( $-0.77$  to  $-2.09$  per cent). Variation: From 83.48 to 89.31 per cent = 5.83 per cent. The changes were not harmonious with those of the first week nor proportionate to the weight of the brains. The specimen in the 6 c. c. to the gram solution lost 1.66 per cent, that weighed daily 1.56 per cent.

Changes in the brain weighed daily: A moderate loss in weight occurred during each of the first five days, after which there was a slow, continuous loss up to the end of the month and beyond. Neither the first nor the second change of solution produced any effect.

## SIXTY-FIVE PARTS 95 PER CENT ALCOHOL AND 35 PARTS 3 PER CENT FORMALIN.

(Alcohol, 65; water, 34; formalin, 1.)

End of first week: Weight of brains in 3 c. c. to the gram solution had fallen in average nearly 4 per cent. The lighter brain lost somewhat more than the heavier one. The specimen in the 6 c. c. to the gram solution lost much more than either of the above; that weighed daily lost slightly more than either of the other two in similar quantity of the preservative.

End of first month: Weight of the two brains in 3 c. c. to the gram solution had diminished but slightly, that of the specimen in 6 c. c. to the gram solution distinctly more, while that of the brain weighed daily was equal.

Changes in the brain weighed daily: The first day a slight (1.56 per cent) rise, then a gradual loss; an insignificant rise the first and third days after the first change of solution, then stability, with slight ups and downs. No rise or fall in weight after the one-month's change of the preservative.



FIG. 24.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SOLUTION OF 95 PARTS OF 95 PER CENT ALCOHOL AND 20 PARTS 5 PER CENT FORMALIN.

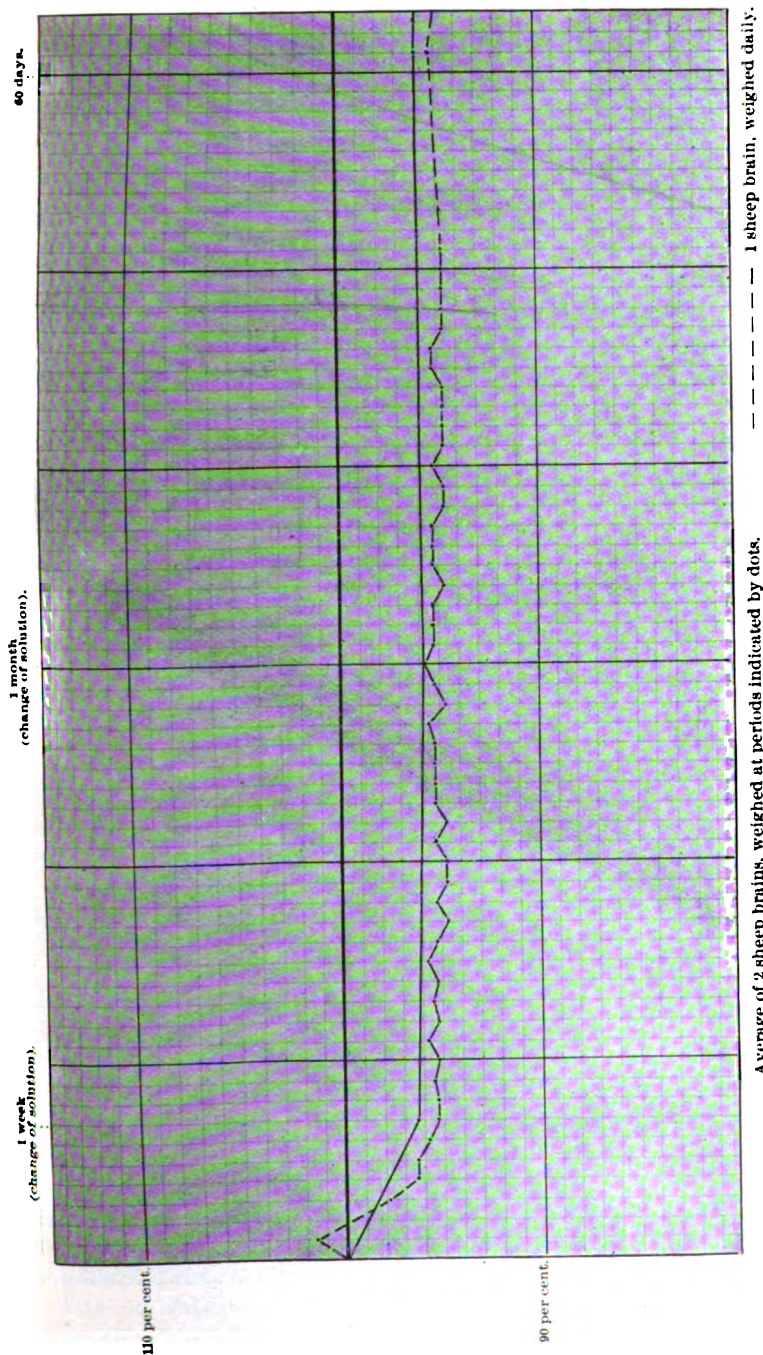


FIG. 25.—CURVE SHOWING WEIGHT CHANGES IN SHEEP BRAINS IN SOLUTION OF 65 PARTS 95 PER CENT ALCOHOL AND 35 PARTS 3 PER CENT FORMALIN. ——— Average of 2 sheep brains, weighed at periods indicated by dots. - - - - - 1 sheep brain, weighed daily.

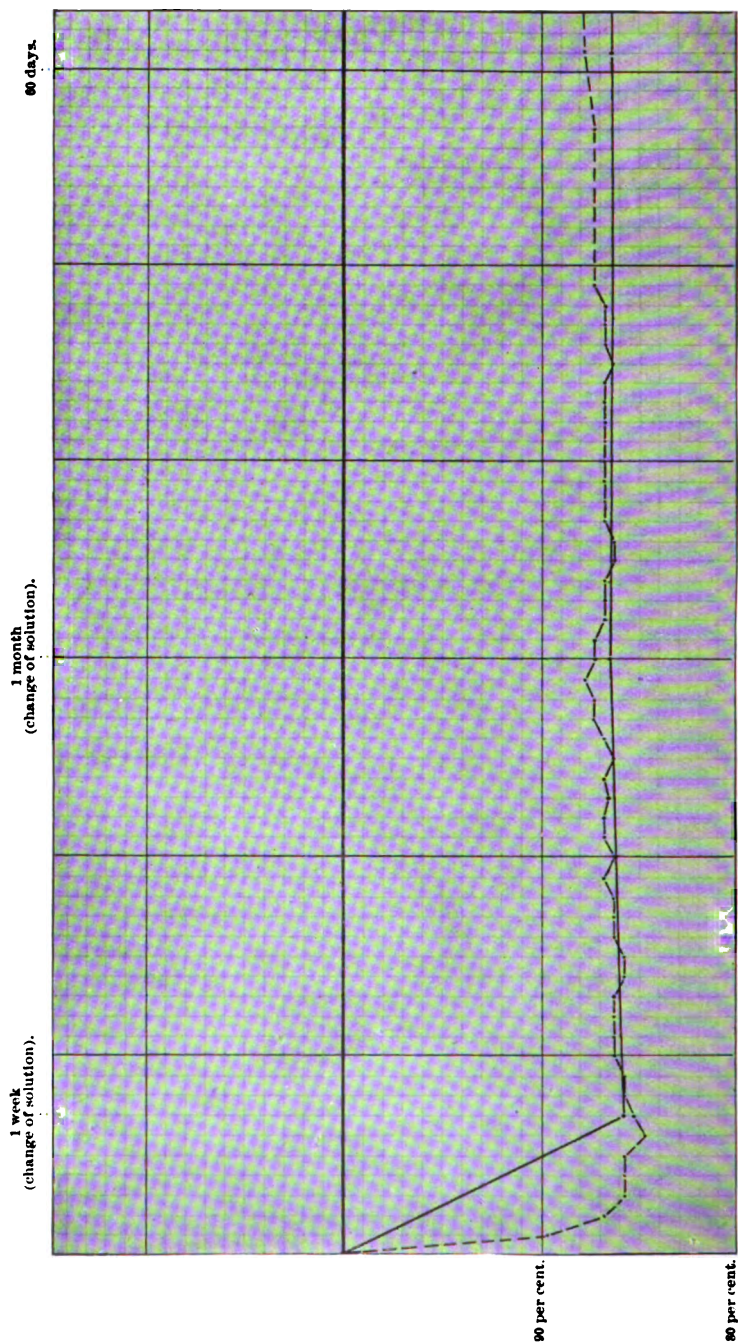


FIG. 26.—Average of 9 sheep brains, weighed at periods indicated by dots.  
 ———— Curve showing weight changes in sheep brains in sodium acetate, sodium chloride, alcohol, and formalin solution.  
 - - - - - 1 sheep brain, weighed daily.

SODIUM ACETATE (FUSED), 130 GRAMS; SODIUM CHLORIDE, 110 GRAMS; FORMALIN, 20 C. C.; 95 PER CENT, ALCOHOL, 460 C. C.; WATER, 540 C. C.

(100 c. c. = sodium acetate, 13; sodium chloride, 11; alcohol, 46; water, 54; formalin, 2.)

End of first week: Weight of brains in the 3 c. c. to the gram solution had diminished in average by 14 per cent, or one-seventh of the original. Variation: From 84.54 (original weight 103.5 grams) to 86.89 per cent (original weight 103 grams) = 2.35 per cent. The two heaviest brains (118.2 and 115.2 grams) lost in weight, respectively, 13.28 and 14.07 per cent, the two lightest ones (101 and 82 grams) 14.36 and 14.64 per cent. The specimen in the 6 c. c. to the gram solution (original weight 110 grams) lost 15 per cent, that weighed every day (original weight 100.8 grams) 14.69 per cent, becoming each relatively lighter than any but one of the above.

End of first month: The solution had been changed, both at the end of the first week and at the end of the first month, only with the specimen weighed daily, without, however, any material difference resulting. Of the nine brains in the 3 c. c. to the gram solution eight had, since the end of the first week, slightly increased in weight, while in one the weight was the same. The gain ranges from 0.51 to 1.15 per cent. Variation: From 85.51 to 87.38 per cent = 1.87 per cent. The changes were quite alike. The specimen in the 6 c. c. to the gram solution gained 0.45 per cent in weight, that weighed daily 2 per cent, or more than any other in the whole series.

Changes in the brain weighed daily: A pronounced loss during the first twenty-four hours, the next day a smaller loss, then three days of stability, and then a slight loss again. After first change a slight rise during the first twenty-four hours and lasting to next day, then a slight loss lasting four days and then slow rising. No marked effect of the second change of solution.

#### SUMMARY.

A glance at the foregoing data and at those of Part I of this paper shows that, with the same preservatives, the results were in substance much alike, but that in the first series there was a much greater variation in results.

The simple formalin solutions all show, with all brains, the same type of effects, consisting of a sharp initial rise in the weight of the specimens, reaching a maximum within less than a week, with a subsequent gradual, long-continued loss. The rise, very clearly shown by the tests on sheep brains, is related in an inverse ratio to the strength of the formalin in the solution. The proportion of loss is much alike and is apparently independent of the formalin percentage, which makes it probable that it consists of simple solution by the water of the preservatives.

The addition of common salt to formalin solutions acts very much like larger proportions of formalin alone. The initial rise is shortened and reduced; in stronger concentrations it is replaced in twenty-four hours by loss; but the subsequent loss in weight proceeds much like that in simple formalin solutions.<sup>a</sup>

Additions of alum to formalin solutions cause, though the specific gravities of the resulting liquids are less, a greater loss in brain weight than the liquids with similar additions of common salt. The weaker solutions caused a smaller initial (one week) but a greater subsequent loss than the concentrated one.<sup>b</sup>

The mixtures of alum, common salt, and formalin are characterized by the great loss which they produce in the weight of the specimens after the first week. There is no advantage whatever in these solutions.

The three mixtures of alcohol with formalin all show an initial loss in the weight of the specimens, but subsequently there is a relatively great stability. Several of the groups (particularly with Stroud's liquid) show actually a little gain following the initial loss. As the proportion of the formalin in any of the solutions is quite insignificant (1 per cent), these effects must be referred nearly wholly to the alcohol and water in the solutions, with the action of which, so far as our knowledge goes, they agree.<sup>c</sup>

Individual variation was present with all the liquids used, most in the 15 per cent formalin and the 1,030 specific gravity common salt solution with 5 per cent formalin, least in the 65 parts of alcohol with 35 parts of 3 per cent formalin (two specimens only) and in the sodium acetate-sodium-chloride-alcohol-formalin mixture. In a large majority of the preservatives the variation was greater at the end of the first month than at the end of the first week; after that it still increased with some solutions, while with others it grew less.

The most potent discernible cause of this individual variation was, as in the cases dealt with in the first part of this paper, the difference in size of the specimens. Another ascertainable cause, but operative to a less extent, was the relative quantity of the preservatives. Even with the sheep brains alone the large ones suffered in the same relative quantity of preservative less change, particularly less ultimate loss, than the small ones; and a double quantity of the liquid, even though most brains chosen for the experiment were large ones, resulted, in the majority of instances, in a loss of weight markedly greater than the average in the smaller proportion of the solution. The variations which remain unaccounted for are of obscure and probably complex

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<sup>a</sup> A greater whiteness of the specimens was again noticeable.

<sup>b</sup> All the specimens showed very good hardening. The diminution in size in those in the concentrated solution was very noticeable.

<sup>c</sup> See Donaldson, *Jour. Morphol.*, 1894, p. 149.

nature; fortunately they are not, at least in normal animal brains, very serious.

The effect of daily weighing the brain was, almost generally, greater than the average loss of weight.

The changing of solution after one week and one month had in a few instances no appreciable effect, but mostly there was a consequent temporary (one to two days) rise in weight which acted as a retarder of the continuing loss.

As to the practical results of these experiments on the value of various brain preservatives for macroscopical purposes, it is plain that neither any of the simple formalin solutions nor any of those to which common salt or alum had been added, is satisfactory. The changes in these liquids are considerable and their continuation prolonged, while there are no compensatory advantages. No good purpose would be served by using any of these mixtures, with one possible exception, in the future; the exception concerns the addition of alum to the solution used for brains of foetuses or the very young, for the purposes of increasing the hardening.

On the other hand, the results obtained with the alcohol and formalin mixtures are most encouraging. These liquids have produced but moderate initial changes (much of which can be done away with by proper modifications of the solutions), followed by the all important feature of subsequent stability. The permanence of this stability has not received as yet a sufficient test of time, but Donaldson's prolonged observations with other alcohol mixtures render it highly probable. The brain is not affected perceptibly by the necessary changes of solution. At all events, it is with this class of preservatives that further experiments are most justifiable.

The addition of the salts in Stroud's liquid gives no superiority over the simple alcohol-formalin solutions. The greater specific gravity of the mixture would commend it on account of the slightly greater prevention of deformation in the specimens, but the somewhat greater initial loss in weight and the subsequent continuous gain are disadvantageous. If equally good results, so far as weight and size of the specimens are concerned, can be obtained with simple mixtures, these should be preferred. Conservation of the form of a specimen in any preservative is largely a matter of proper care.

As a result of the data obtained by the experiments reported upon in this paper, the tentative regulations below outlined concerning brain preservation have been made in the laboratory of physical anthropology of the U. S. National Museum. They can, it is hoped, be pursued with daily and longer periodical weighings of the specimens, and with whatever modifications may become indicated in the liquids, until a substantiated and as simple as possible method of brain preservation has been determined. It would be very desirable if a concurrent

microscopical investigation could be made in some other laboratory, more suited for that purpose, as to the relative value of the various preservatives for the purposes of histology and pathology.

**PRESENT REGULATIONS CONCERNING BRAIN PRESERVATION IN THE  
LABORATORY OF PHYSICAL ANTHROPOLOGY, UNITED STATES  
NATIONAL MUSEUM.**

Remove the brain as fresh as possible and with the least injury, without the dura; weigh at once; measure the proper solution into a jar of suitable size; place sufficient absorbent cotton on the bottom to protect the specimen from deformation by pressure; in larger specimens introduce a little cotton between the cerebrum and cerebellum, and lay the brain in, base downward. If necessary, support the hemispheres in proper position by additional cotton; close jar as nearly air-tight as possible and place on a shelf out of direct light of the sun; weigh, after the regular drainage, on the eighth day and change solution. Weigh again on the thirty-first day, at the end of three months after reception, and every three months (as long as the experiments last).

*Solutions and proportions.*

|  | Distilled<br>water. | 95 per cent<br>alcohol. | Formalin. |
|--|---------------------|-------------------------|-----------|
|  | Parts.              | Parts.                  | Parts.    |
| Brains up to 50 grams in weight.....   | 45                  | 52                      | 3         |
| Brains 51 to 150 grams in weight.....  | 40                  | 57                      | 3         |
| Brains 151 to 300 grams in weight..... | 35                  | 62                      | 3         |
| Brains 301 to 900 grams in weight..... | 30                  | 67                      | 3         |
| Brains above 900 grams in weight.....  | 25                  | 75                      | 3         |

Quantity of liquid: All specimens above 30 grams in weight, use 4 c. c. to the gram; brains 15-29 grams, use 6 c. c. to the gram; brains less than 15 grams use 75 c. c. per each specimen.<sup>a</sup>

For brains of fetuses and the very young use one-half saturated solution of alum in place of water and 10 per cent formalin. Where there is danger of an injury to the brain during weighing, on account of its softness, weigh it indirectly; approximate the quantity of the solution to the calculated weight of the brain; weigh jar and all before and after introduction of the specimen, and subtract, bringing afterwards the liquid to exact proportion.

<sup>a</sup> Larger quantity of liquid made necessary by the size of the smallest convenient jar.

## ABSTRACT.

| Preservative.  | 3 c. c. per gram (weight at periods indicated below). |   |                     |  |                     |   |                     |
|--|---|---|---------------------|--|---------------------|---|---------------------|
|  | Number of brains.                                     | Average per cent of original weight at the end of 1 week. | Per cent variation. | Average per cent of original weight at the end of 1 month. | Per cent variation. | Average per cent of original weight at the end of 2 months. | Per cent variation. |
| 3 per cent formalin.....   | 9   | 121.4   | 5.4                 | 121.3  | 6.8                 | 118.2   | 5.7                 |
| 5 per cent formalin.....   | 9   | 117.9   | 3.9                 | 116.0  | 5.8                 | 112.8   | 5.3                 |
| 10 per cent formalin.....  | 9   | 115.0   | 4.0                 | 113.1  | 5.3                 | 110.3   | 4.0                 |
| 15 per cent formalin.....  | 9   | 112.8   | 8.9                 | 111.0  | 9.8                 | 106.6   | 10.5                |
| Saturated solution of common salt with 5 per cent formalin.....                                      | 9   | 92.9  | 4.9                 | 89.3   | 6.2                 | 86.8  | 6.5                 |
| 1,000 sp. gr. common salt solution with 5 per cent formalin.....                                     | 9   | 97.9  | 10.3                | 96.9   | 9.9                 | 93.6  | 10.8                |
| 1,015 sp. gr. common salt solution with 5 per cent formalin.....                                     | 2   | 101.9   | (1.2)               | 100.3  | (1.4)               | 96.9  | (1.3)               |
| Saturated solution of alum with 5 per cent formalin.....   | 9   | 77.2  | 7.5                 | 71.5   | 10.4                | 71.0  | 3.7                 |
| One-third saturated solution of alum with 5 per cent formalin.....                                   | 9   | 99.4  | 3.5                 | 93.2   | 7.1                 | 88.0  | 10.1                |
| One-fifth saturated solution of alum with 5 per cent formalin.....                                   | 9   | 101.2   | 4.0                 | 92.1   | 7.9                 | 85.2  | 6.6                 |
| One-third saturated solution of alum with common salt to 1,080 sp. gr. and 10 per cent formalin..... | 9   | 92.1  | 6.7                 | 81.1   | 7.2                 | 71.2  | 11.4                |
| One-third saturated solution of alum with common salt to 1,080 sp. gr. and 5 per cent formalin.....  | 9   | 102.4   | 3.6                 | 85.6   | 8.1                 | 76.3  | 8.9                 |
| 80 parts of alcohol and 20 parts of 5 per cent formalin.....   | 3   | 88.5  | 6.2                 | 86.9   | 5.8                 | 87.0  | 7.1                 |
| 65 parts of alcohol and 35 parts of 3 per cent formalin.....   | 2   | 96.3  | (1.1)               | 95.8   | (1.2)               | 96.0  | (1.7)               |
| Sodium acetate, sodium chloride, formalin, and alcohol solution.....                                 | 9   | 85.9  | 2.3                 | 86.5   | 1.9                 | 86.4  | 1.9                 |

| Preservative.  | 6 c. c. per gram (weight at periods indicated below). |  |          |          | 3 c. c. per gram (weighed every day). |  |          |          |
|--|---|--|----------|----------|---------------------------------------|--|----------|----------|
|  | Number of brains.                                     | Per cent of original weight at the end of— |          |          | Number of brains.                     | Per cent of original weight at the end of— |          |          |
|  |   | 1 week.                                    | 1 month. | 2 months |                                       | 1 week.                                    | 1 month. | 2 months |
| 3 per cent formalin.....   | 1   | 118.9                                      | 116.9    | 113.9    | 1                                     | 117.6                                      | 115.2    | 113.2    |
| 5 per cent formalin.....   | 1   | 118.9                                      | 116.4    | 111.4    | 1                                     | 117.8                                      | 115.0    | 112.2    |
| 10 per cent formalin.....  | 1   | 114.0                                      | 112.8    | 108.4    | 1                                     | 116.2                                      | 112.2    | 110.3    |
| 15 per cent formalin.....  | 1   | 109.1                                      | 102.6    | 96.9     | 1                                     | 108.5                                      | 104.7    | 99.5     |
| Saturated solution of common salt with 5 per cent formalin.....                                      | 1   | 93.2                                       | 90.0     | 81.7     | 1                                     | 92.1                                       | .....    | .....    |
| 1,000 sp. gr. common salt solution with 5 per cent formalin.....                                     | 1   | 94.3                                       | 92.4     | 89.0     | 1                                     | 97.1                                       | 94.2     | 91.2     |
| 1,015 sp. gr. common salt solution with 5 per cent formalin.....                                     | 1   | 102.0                                      | 99.6     | 95.1     | 1                                     | 101.3                                      | 98.25    | 93.4     |
| Saturated solution of alum with 5 per cent formalin.....   | 1   | 82.3                                       | 73.5     | 71.5     | 1                                     | 74.2                                       | 70.3     | 69.3     |
| One-third saturated solution of alum with 5 per cent formalin.....                                   | 1   | 97.9                                       | 92.6     | 88.9     | 1                                     | 95.8                                       | 85.2     | 79.2     |
| One-fifth saturated solution of alum with 5 per cent formalin.....                                   | 1   | 98.4                                       | 90.9     | 84.1     | 1                                     | 102.0                                      | 92.3     | 81.3     |
| One-third saturated solution of alum with common salt to 1,080 sp. gr. and 10 per cent formalin..... | 1   | 93.9                                       | 83.1     | 74.0     | 1                                     | 89.0                                       | 78.6     | 73.3     |
| One-third saturated solution of alum with common salt to 1,080 sp. gr. and 5 per cent formalin.....  | 1   | 98.3                                       | 88.4     | 84.2     | 1                                     | 96.4                                       | 86.6     | 81.0     |
| 80 parts of alcohol and 20 parts of 5 per cent formalin.....   | 1   | 84.9                                       | 83.5     | 82.0     | 1                                     | 88.5                                       | 87.1     | 83.0     |
| 65 parts of alcohol and 35 parts of 3 per cent formalin.....   | 1   | 90.2                                       | 87.9     | 88.4     | 1                                     | 96.3                                       | 95.3     | 95.3     |
| Sodium acetate, sodium chloride, formalin, and alcohol solution.....                                 | 1   | 85.0                                       | 85.4     | 85.4     | 1                                     | 85.3                                       | 87.3     | .....    |

## CHANGES IN INDIVIDUAL SHEEP BRAINS.

*Preservative: 3 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number.         | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|-----------------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|                 |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|                 | 1905.            | <i>Grams.</i>                                 | <i>Grams.</i>                 |                              | <i>Grams.</i>                  |                              |   | 1905.                 | <i>Grams.</i>    |                              |
| 2...            | June 6           | 110.5   | 131.0                         | 118.55                       | 129.5                          | 117.19                       | -1.15   | Aug. 6                | 127.0            | 114.98                       |
| 3...            | do               | 98.0  | 119.2                         | 121.63                       | 119.3                          | 121.94                       | + .08   | do                    | 116.0            | 118.36                       |
| 4...            | do               | 102.0   | 126.0                         | 123.53                       | 126.5                          | 124.02                       | + .39   | do                    | 123.0            | 120.59                       |
| 5...            | do               | 100.2   | 119.5                         | 119.26                       | 119.0                          | 118.76                       | - .42   | do                    | 115.5            | 115.26                       |
| 6...            | do               | 117.5   | 141.0                         | 120.00                       | 141.5                          | 120.42                       | + .35   | do                    | 138.5            | 117.87                       |
| 7...            | do               | 94.0  | 113.0                         | 120.21                       | 113.5                          | 120.74                       | + .44   | do                    | 110.5            | 117.55                       |
| 8...            | do               | 93.2  | 113.8                         | 122.13                       | 114.0                          | 122.32                       | + .17   | do                    | 110.0            | 118.02                       |
| 9...            | do               | 102.5   | 127.0                         | 123.92                       | 126.0                          | 122.92                       | - .78   | do                    | 123.5            | 120.48                       |
| 10 <sup>a</sup> | do               | 100.5   | 119.5                         | 118.90                       | 117.5                          | 118.00                       | -1.67   | do                    | 114.5            | 113.93                       |
| 11...           | do               | 95.5  | 118.0                         | 123.56                       | 118.0                          | 123.56                       |   | do                    | 115.0            | 120.42                       |

<sup>a</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 7, 1905. Original weight, 102 grams.]

| At the end of day.   | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                      | <i>Grams.</i>    |                              |  |                    | <i>Grams.</i>    |                              |  |
| First                | 114.5            | 112.25                       | +12.25   | Twenty-ninth       | 118.0            | 115.68                       | ± 0.00   |
| Second               | 118.5            | 116.17                       | + 3.92   | Thirtieth          | 117.5            | 115.19                       | - .49  |
| Third                | 120.0            | 117.64                       | + 1.47   | Thirty-first       | 120.0            | 117.64                       | + 2.45   |
| Fourth               | 120.5            | 118.13                       | + .49  | Thirty-second      | 120.5            | 118.13                       | + .49  |
| Fifth                | 120.5            | 118.13                       | + .00  | Thirty-third       | 120.0            | 117.64                       | - .49  |
| Sixth                | 120.0            | 117.64                       | - .49  | Thirty-fourth      | 119.5            | 117.15                       | - .49  |
| Seventh <sup>a</sup> | 120.0            | 117.64                       | + .00  | Thirty-fifth       | 119.5            | 117.15                       | ± .00  |
| Eighth               | 123.2            | 120.59                       | + 2.95   | Thirty-sixth       | 119.5            | 117.15                       | ± .00  |
| Ninth                | 124.0            | 121.56                       | + .97  | Thirty-seventh     | 119.0            | 116.67                       | - .48  |
| Tenth                | 124.0            | 121.56                       | ± .00  | Thirty-eighth      | 118.5            | 116.17                       | - .50  |
| Twelfth              | 123.0            | 120.58                       | - .98  | Thirty-ninth       | 119.0            | 116.67                       | + .50  |
| Thirteenth           | 122.5            | 120.09                       | - .49  | Fortieth           | 118.0            | 115.68                       | - .99  |
| Fourteenth           | 122.0            | 119.61                       | - .48  | Forty-first        | 118.0            | 115.68                       | ± .00  |
| Fifteenth            | 121.5            | 119.11                       | - .50  | Forty-second       | 117.5            | 115.19                       | - .49  |
| Sixteenth            | 121.5            | 119.11                       | ± .00  | Forty-third        | 117.5            | 115.19                       | ± .00  |
| Seventeenth          | 121.0            | 118.62                       | - .49  | Forty-fourth       | 117.0            | 114.70                       | - .49  |
| Eighteenth           | 120.5            | 118.13                       | - .49  | Forty-fifth        | 116.5            | 114.21                       | - .49  |
| Nineteenth           | 120.5            | 118.13                       | ± .00  | Forty-sixth        | 116.5            | 114.21                       | ± .00  |
| Twentieth            | 120.0            | 117.64                       | - .49  | Forty-seventh      | 116.5            | 114.21                       | ± .00  |
| Twenty-first         | 119.5            | 117.15                       | - .49  | Forty-eighth       | 116.0            | 113.72                       | - .49  |
| Twenty-second        | 118.5            | 116.17                       | - .98  | Forty-ninth        | 116.5            | 114.21                       | + .49  |
| Twenty-third         | 119.0            | 116.67                       | + .50  | Fiftieth           | 116.0            | 113.72                       | - .49  |
| Twenty-fourth        | 119.0            | 116.67                       | ± .00  | Fifty-first        | 116.0            | 113.72                       | ± .00  |
| Twenty-fifth         | 118.5            | 116.17                       | - .50  | Fifty-eighth       | 115.5            | 113.23                       | - .49  |
| Twenty-sixth         | 118.0            | 115.68                       | - .49  | Sixty-fifth        | 113.5            | 111.22                       | - 2.01   |
| Twenty-seventh       | 118.0            | 115.68                       | ± .00  | Seventy-second     | 112.5            | 110.29                       | - .98  |
| Twenty-eighth        | 118.0            | 115.68                       | ± .00  |                    |                  |                              |  |

<sup>a</sup> Change of solution.

130 per cent.

120 per cent.

110 per cent

90 per cent.

80 per cent.

70 per cent.

FIG. 2

Proc. I



*Preservative: 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number.         | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|-----------------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|                 |                  | Grams.  | Grams.                        |                              | Grams.                         |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|                 | 1905.            |   |                               |                              |                                |                              |   | 1905.                 |                  |                              |
| 12..            | June 6           | 117.0   | 138.5                         | 118.37                       | 140.0                          | 119.66                       | +1.08   | Aug. 6                | 135.5            | 115.81                       |
| 13..            | June 7           | 114.0   | 133.5                         | 117.10                       | 130.8                          | 114.73                       | -2.02   | Aug. 7                | 126.0            | 110.53                       |
| 14..            | do               | 101.6   | 118.5                         | 116.63                       | 115.7                          | 113.87                       | -2.36   | do                    | 112.5            | 110.72                       |
| 16..            | do               | 98.5  | 116.0                         | 117.76                       | 113.7                          | 115.43                       | -1.98   | do                    | 111.0            | 112.69                       |
| 17..            | do               | 99.5  | 117.0                         | 117.58                       | 114.2                          | 114.77                       | -2.39   | do                    | 111.5            | 112.66                       |
| 18..            | do               | 99.0  | 118.8                         | 120.00                       | 116.6                          | 117.78                       | -1.85   | do                    | 113.5            | 114.65                       |
| 19..            | do               | 95.5  | 114.0                         | 119.37                       | 112.0                          | 117.28                       | -1.75   | do                    | 109.0            | 114.13                       |
| 20..            | do               | 99.0  | 116.8                         | 117.96                       | 114.0                          | 115.15                       | -2.89   | do                    | 111.0            | 112.12                       |
| 21..            | do               | 119.7   | 139.0                         | 116.12                       | 137.8                          | 115.12                       | -.86  | do                    | 134.5            | 112.37                       |
| 22 <sup>a</sup> | do               | 100.5   | 119.5                         | 118.90                       | 117.0                          | 116.42                       | -2.09   | do                    | 112.0            | 111.44                       |

<sup>a</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 6, 1905. Original weight, 106.5 grams.]

| At the end of day.         | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day.           | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------------|------------------|------------------------------|--|------------------------------|------------------|------------------------------|--|
|                            | Grams.           |                              |  |                              | Grams.           |                              |  |
| First .....                | 119.0            | 111.78                       | +11.73   | Twenty-ninth .....           | 122.9            | 115.40                       | +0.38  |
| Second .....               | 123.0            | 115.49                       | + 3.76   | Thirtieth <sup>a</sup> ..... | 122.5            | 115.02                       | -.38   |
| Third .....                | 125.2            | 117.55                       | + 2.06   | Thirty-first .....           | 123.5            | 115.96                       | +.94   |
| Fourth .....               | 126.5            | 118.77                       | + 1.22   | Thirty-second .....          | 123.0            | 115.49                       | -.47   |
| Fifth .....                | 126.0            | 118.31                       | -.46   | Thirty-third .....           | 122.0            | 114.55                       | -.94   |
| Sixth .....                | 125.0            | 117.37                       | -.94   | Thirty-fourth .....          | 121.5            | 114.08                       | -.47   |
| Seventh <sup>a</sup> ..... | 125.5            | 117.84                       | + .47  | Thirty-fifth .....           | 121.5            | 114.08                       | ± .00  |
| Eighth .....               | 126.5            | 118.77                       | + .93  | Thirty-sixth .....           | 121.5            | 114.08                       | ± .00  |
| Ninth .....                | 126.5            | 118.77                       | ± .00  | Thirty-seventh .....         | 121.5            | 114.08                       | ± .00  |
| Tenth .....                | 125.5            | 117.84                       | -.93   | Thirty-eighth .....          | 121.5            | 114.08                       | ± .00  |
| Eleventh .....             | 126.0            | 118.31                       | + .47  | Thirty-ninth .....           | 121.0            | 113.61                       | -.47   |
| Thirteenth .....           | 125.0            | 117.37                       | -.94   | Fortieth .....               | 121.5            | 114.08                       | + .47  |
| Fourteenth .....           | 125.5            | 117.84                       | + .47  | Forty-first .....            | 121.0            | 113.61                       | -.47   |
| Fifteenth .....            | 125.0            | 117.37                       | -.47   | Forty-second .....           | 120.5            | 113.14                       | -.47   |
| Sixteenth .....            | 124.8            | 117.18                       | -.19   | Forty-third .....            | 120.0            | 112.67                       | -.47   |
| Seventeenth .....          | 124.5            | 116.90                       | -.28   | Forty-fourth .....           | 120.0            | 112.67                       | ± .00  |
| Eighteenth .....           | 124.5            | 116.90                       | ± .00  | Forty-fifth .....            | 120.0            | 112.67                       | ± .00  |
| Nineteenth .....           | 125.2            | 117.56                       | + .66  | Forty-sixth .....            | 120.0            | 112.67                       | ± .00  |
| Twentieth .....            | 125.0            | 117.37                       | -.19   | Forty-seventh .....          | 120.0            | 112.67                       | ± .00  |
| Twenty-first .....         | 123.5            | 115.96                       | - 1.41   | Forty-eighth .....           | 120.5            | 113.14                       | + .47  |
| Twenty-second .....        | 123.5            | 115.96                       | ± .00  | Forty-ninth .....            | 120.0            | 112.67                       | -.47   |
| Twenty-third .....         | 123.8            | 116.24                       | + .28  | Fiftieth .....               | 120.0            | 112.67                       | ± .00  |
| Twenty-fourth .....        | 123.0            | 115.49                       | -.75   | Fifty-first .....            | 119.5            | 112.21                       | -.46   |
| Twenty-fifth .....         | 123.0            | 115.49                       | ± .00  | Fifty-eighth .....           | 119.5            | 112.21                       | ± .00  |
| Twenty-sixth .....         | 123.0            | 115.49                       | ± .00  | Sixty-fifth .....            | 119.0            | 111.73                       | -.48   |
| Twenty-seventh .....       | 122.5            | 115.02                       | -.47   | Seventy-second .....         | 117.0            | 109.86                       | -1.87  |
| Twenty-eighth .....        | 122.5            | 115.02                       | ± .00  |                              |                  |                              |  |

<sup>a</sup> Change of solution.

*Preservative: 10 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number.         | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Percent of original weight. | Weight of brain after 1 month. | Percent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|-----------------|------------------|---|-------------------------------|-----------------------------|--------------------------------|-----------------------------|---|-----------------------|------------------|------------------------------|
|                 |                  |   |                               |                             |                                |                             |   | Date.                 | Weight of brain. | Per cent of original weight. |
|                 | 1905.            | Grams.  | Grams.                        |                             | Grams.                         |                             |   | 1905.                 | Grams.           |                              |
| 24.             | June 7           | 110.5   | 127.5                         | 115.38                      | 125.5                          | 113.57                      | -1.56   | Aug. 7                | 123.0            | 111.31                       |
| 25.             | do               | 97.0  | 109.5                         | 112.88                      | 107.0                          | 110.31                      | -2.28   | do                    | 105.0            | 108.25                       |
| 26.             | do               | 97.5  | 110.0                         | 112.84                      | 110.5                          | 113.33                      | -.45  | do                    | 108.0            | 110.77                       |
| 27.             | do               | 97.0  | 112.2                         | 115.67                      | 108.5                          | 111.85                      | -3.29   | do                    | 106.5            | 109.79                       |
| 28.             | June 8           | 96.5  | 111.5                         | 115.54                      | 109.5                          | 113.47                      | -1.79   | Aug. 8                | 106.0            | 109.84                       |
| 29.             | do               | 112.0   | 128.5                         | 114.73                      | 126.5                          | 112.95                      | -1.56   | do                    | 123.0            | 109.82                       |
| 30.             | do               | 102.0   | 117.5                         | 115.19                      | 114.5                          | 112.25                      | -2.55   | do                    | 111.5            | 109.31                       |
| 31.             | do               | 110.5   | 128.5                         | 116.29                      | 127.0                          | 114.93                      | -1.17   | do                    | 124.0            | 112.21                       |
| 32.             | do               | 80.0  | 93.5                          | 116.87                      | 92.5                           | 115.63                      | -1.07   | do                    | 89.0             | 111.25                       |
| 33 <sup>a</sup> | do               | 125.0   | 142.5                         | 114.00                      | 141.0                          | 112.80                      | -1.06   | do                    | 135.5            | 108.40                       |

<sup>a</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 8, 1905. Original weight, 102 grams.]

| At the end of day.   | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                      | Grams.           |                              |  |                    | Grams.           |                              |  |
| First                | 113.5            | 111.27                       | +11.27   | Twenty-ninth       | 114.7            | 112.47                       | -0.08  |
| Second               | 116.0            | 113.72                       | +2.45  | Thirtieth          | 114.5            | 112.25                       | -.22   |
| Third                | 118.0            | 115.68                       | +1.96  | Thirty-first       | 116.0            | 113.72                       | +1.47  |
| Fourth               | 118.0            | 115.68                       | ± .00  | Thirty-second      | 116.0            | 113.72                       | ± .00  |
| Fifth                | 118.5            | 116.17                       | + .49  | Thirty-third       | 116.0            | 113.72                       | ± .00  |
| Sixth                | 119.0            | 116.67                       | + .00  | Thirty-fourth      | 115.5            | 113.23                       | -.49   |
| Seventh <sup>a</sup> | 118.5            | 116.17                       | -.49   | Thirty-fifth       | 116.0            | 113.72                       | + .49  |
| Eighth               | 119.8            | 117.45                       | +1.28  | Thirty-sixth       | 115.5            | 113.23                       | -.49   |
| Ninth                | 120.5            | 118.13                       | + .68  | Thirty-seventh     | 115.5            | 113.23                       | ± .00  |
| Tenth                | 120.0            | 117.64                       | -.49   | Thirty-eighth      | 115.0            | 112.74                       | -.49   |
| Twelfth              | 119.2            | 116.86                       | -.78   | Thirty-ninth       | 115.0            | 112.74                       | ± .00  |
| Thirteenth           | 119.0            | 116.67                       | -.19   | Fortieth           | 114.5            | 112.25                       | -.49   |
| Fourteenth           | 118.5            | 116.17                       | -.50   | Forty-first        | 114.0            | 111.76                       | -.49   |
| Fifteenth            | 117.5            | 115.19                       | -.98   | Forty-second       | 114.0            | 111.76                       | ± .00  |
| Sixteenth            | 117.5            | 115.19                       | ± .00  | Forty-third        | 113.5            | 111.27                       | -.49   |
| Seventeenth          | 117.5            | 115.19                       | ± .00  | Forty-fourth       | 113.5            | 111.27                       | ± .00  |
| Eighteenth           | 117.5            | 115.19                       | ± .00  | Forty-fifth        | 113.0            | 110.78                       | -.49   |
| Nineteenth           | 117.0            | 114.71                       | -.48   | Forty-sixth        | 113.5            | 111.27                       | + .49  |
| Twentieth            | 116.5            | 114.21                       | -.50   | Forty-seventh      | 113.0            | 110.78                       | -.49   |
| Twenty-first         | 116.5            | 114.21                       | ± .00  | Forty-eighth       | 113.0            | 110.78                       | ± .00  |
| Twenty-second        | 116.0            | 113.72                       | -.49   | Forty-ninth        | 113.0            | 110.78                       | ± .00  |
| Twenty-third         | 115.5            | 113.23                       | -.49   | Fiftieth           | 112.5            | 110.29                       | -.49   |
| Twenty-fourth        | 115.0            | 112.74                       | -.49   | Fifty-first        | 113.0            | 110.78                       | + .49  |
| Twenty-fifth         | 115.7            | 113.43                       | + .69  | Sixtieth           | 112.5            | 110.29                       | -.49   |
| Twenty-sixth         | 115.0            | 112.74                       | -.69   | Sixty-seventh      | 111.0            | 108.82                       | -1.47  |
| Twenty-seventh       | 115.0            | 112.74                       | ± .00  | Seventy-fourth     | 109.5            | 107.35                       | -1.47  |
| Twenty-eighth        | 114.8            | 112.55                       | -.19   |                    |                  |                              |  |

<sup>a</sup> Change of solution.

*Preservative: 15 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  | Grams.  | Grams.                        |                              | Grams.                         |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
| 34.     | 1905. June 8     | 107.0   | 121.0                         | 113.08                       | 118.2                          | 110.47                       | -2.31   | 1905. Aug. 8          | 114.0            | 106.54                       |
| 35.     | do               | 111.0   | 126.0                         | 113.61                       | 123.5                          | 111.26                       | -1.98   | do                    | 120.0            | 108.11                       |
| 36.     | do               | 91.0  | 106.0                         | 116.48                       | 105.0                          | 115.38                       | - .94   | do                    | 101.0            | 110.99                       |
| 37.     | do               | 94.0  | 105.0                         | 111.70                       | 103.5                          | 110.11                       | -1.43   | do                    | 100.0            | 106.38                       |
| 38.     | do               | 106.0   | 122.0                         | 115.09                       | 120.4                          | 113.58                       | -1.31   | do                    | 117.0            | 110.38                       |
| 39.     | do               | 111.8   | 129.2                         | 115.56                       | 127.0                          | 113.59                       | -1.70   | do                    | 122.5            | 109.57                       |
| 40.     | do               | 119.0   | 133.4                         | 112.10                       | 130.5                          | 109.66                       | -2.17   | do                    | 126.5            | 106.30                       |
| 41.     | June 9           | 103.0   | 113.5                         | 110.19                       | 112.5                          | 109.22                       | - .88   | Aug. 9                | 103.5            | 100.48                       |
| 42.     | do               | 98.5  | 106.0                         | 107.61                       | 104.0                          | 105.58                       | -1.88   | do                    | 99.5             | 101.01                       |
| 43.     | do               | 97.0  | 106.8                         | 109.08                       | 99.5                           | 102.58                       | -5.95   | do                    | 94.0             | 96.91                        |

<sup>a</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 9, 1905. Original weight, 105.5 grams.]

| At the end of day.   | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                      | Grams.           |                              |  |                    | Grams.           |                              |  |
| First                | 112.0            | 106.16                       | +6.16  | Twenty-ninth       | 111.0            | 105.21                       | ± 0.00   |
| Second               | 114.0            | 108.06                       | +1.89  | Thirtieth          | 110.5            | 104.74                       | - .47  |
| Third                | 115.0            | 109.00                       | + .95  | Thirty-first       | 111.5            | 105.68                       | + .94  |
| Fourth               | 116.0            | 109.95                       | + .95  | Thirty-second      | 111.0            | 106.21                       | - .47  |
| Fifth                | 114.5            | 108.53                       | -1.42  | Thirty-third       | 111.5            | 106.68                       | + .47  |
| Sixth                | 115.2            | 109.19                       | + .66  | Thirty-fourth      | 111.2            | 106.40                       | - .28  |
| Seventh <sup>a</sup> | 114.5            | 108.53                       | - .66  | Thirty-fifth       | 110.5            | 104.74                       | - .66  |
| Eighth               | 115.5            | 109.48                       | + .95  | Thirty-sixth       | 110.5            | 104.74                       | ± .00  |
| Tenth                | 114.5            | 108.53                       | - .95  | Thirty-seventh     | 110.5            | 104.74                       | ± .00  |
| Eleventh             | 115.0            | 109.00                       | + .47  | Thirty-eighth      | 110.0            | 104.26                       | - .48  |
| Twelfth              | 114.5            | 108.53                       | - .47  | Thirty-ninth       | 109.5            | 103.79                       | - .47  |
| Thirteenth           | 114.0            | 108.06                       | - .48  | Fortieth           | 109.5            | 103.79                       | ± .00  |
| Fourteenth           | 114.0            | 108.06                       | ± .00  | Forty-first        | 109.0            | 103.31                       | - .48  |
| Fifteenth            | 113.5            | 107.58                       | - .47  | Forty-second       | 108.0            | 102.37                       | - .94  |
| Sixteenth            | 113.7            | 107.77                       | + .19  | Forty-third        | 107.5            | 101.90                       | - .47  |
| Seventeenth          | 113.5            | 107.58                       | - .19  | Forty-fourth       | 107.5            | 101.90                       | ± .00  |
| Eighteenth           | 113.0            | 107.11                       | - .47  | Forty-fifth        | 107.5            | 101.90                       | ± .00  |
| Nineteenth           | 112.0            | 106.16                       | - .95  | Forty-sixth        | 106.5            | 100.95                       | - .95  |
| Twentieth            | 113.0            | 107.11                       | + .95  | Forty-seventh      | 107.0            | 101.42                       | + .47  |
| Twenty-first         | 112.5            | 106.68                       | - .48  | Forty-eighth       | 106.5            | 100.95                       | - .47  |
| Twenty-second        | 111.5            | 105.68                       | - .95  | Forty-ninth        | 106.5            | 100.95                       | ± .00  |
| Twenty-third         | 112.0            | 106.16                       | + .48  | Fiftieth           | 106.0            | 100.47                       | - .48  |
| Twenty-fourth        | 111.2            | 105.40                       | - .76  | Fifty-first        | 106.0            | 100.47                       | ± .00  |
| Twenty-fifth         | 111.5            | 105.68                       | + .28  | Fifty-ninth        | 105.0            | 99.52                        | - .95  |
| Twenty-sixth         | 111.5            | 105.68                       | ± .00  | Sixty-sixth        | 104.0            | 98.58                        | - .94  |
| Twenty-seventh       | 111.0            | 105.21                       | - .47  | Seventy-third      | 103.5            | 98.10                        | - .48  |
| Twenty-eighth        | 111.0            | 105.21                       | ± .00  |                    |                  |                              |  |

<sup>a</sup> Change of solution.

*Preservative: Saturated solution of salt, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1905.            | <i>Grams.</i>                                 | <i>Grams.</i>                 |                              | <i>Grams.</i>                  |                              |   | 1905.                 | <i>Grams.</i>    |                              |
| 56.     | June 9           | 95.2  | 86.0                          | 90.33                        | 81.5                           | 85.61                        | -5.23   | Aug. 9                | 80.5             | 84.56                        |
| 57.     | .....do          | 105.0   | 99.0                          | 94.28                        | 96.5                           | 90.95                        | -3.54   | .....do               | 92.5             | 88.09                        |
| 58.     | .....do          | 107.7   | 100.5                         | 93.31                        | 96.5                           | 89.78                        | -3.98   | .....do               | 95.0             | 88.21                        |
| 59.     | .....do          | 103.0   | 94.2                          | 91.45                        | 90.5                           | 87.86                        | -3.93   | .....do               | 89.5             | 86.89                        |
| 60.     | .....do          | 102.0   | 93.5                          | 91.66                        | 89.5                           | 87.74                        | -4.28   | .....do               | 88.5             | 86.76                        |
| 61.     | June 10          | 102.5   | 93.5                          | 91.22                        | 90.0                           | 87.80                        | -3.74   | Aug. 10               | 84.5             | 82.44                        |
| 62.     | .....do          | 104.0   | 99.0                          | 95.19                        | 95.5                           | 91.82                        | -3.54   | .....do               | 92.5             | 88.94                        |
| 64.     | .....do          | 89.7  | 84.5                          | 94.20                        | 81.5                           | 90.86                        | -3.56   | .....do               | 78.5             | 87.51                        |
| 65.     | .....do          | 84.5  | 79.5                          | 94.08                        | 77.0                           | 91.12                        | -3.15   | .....do               | 74.0             | 87.57                        |
| 66 a    | .....do          | 95.5  | 89.0                          | 93.19                        | 86.0                           | 90.05                        | -3.37   | .....do               | 78.0             | 81.67                        |

a At 6 c. c. per gram.

[Brain weighed daily. Received June 10, 1905. Original weight, 101 grams.]

| Number. | Date weighed. | Absolute weight. | Per cent of original weight. | Number. | Date weighed. | Absolute weight. | Per cent of original weight. |
|---------|---------------|------------------|------------------------------|---------|---------------|------------------|------------------------------|
|         |               |                  |                              |         |               |                  |                              |
|         |               | <i>Grams.</i>    |                              |         |               | <i>Grams.</i>    |                              |
| 63.     | June 11, 1905 | 95.5             | 94.55                        | 63.     | June 15, 1905 | 93.2             | 92.27                        |
|         | June 12, 1905 | 95.0             | 94.06                        |         | June 16, 1905 | 93.5             | 92.57                        |
|         | June 13, 1905 | 94.5             | 93.56                        |         | June 17, 1905 | 93.0             | 92.08                        |
|         | June 14, 1905 | 93.5             | 92.57                        |         |               |                  |                              |

*Preservative: 1,030 sp. gr. salt solution, with 5 per cent formalin.*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Percent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|--|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |  | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1906.            | Grams.  | Grams.                        |                              | Grams.                         |                              |  | 1906.                 | Grams.           |                              |
| 100.    | June 13          | 112.0   | 115.0                         | 102.68                       | 113.5                          | 101.84                       | -1.30  | Aug 13                | 111.0            | 99.11                        |
| 101.    | do               | 101.0   | 97.5                          | 96.58                        | 96.0                           | 95.05                        | -1.54  | do                    | 93.5             | 92.57                        |
| 102.    | do               | 107.0   | 111.5                         | 104.20                       | 109.5                          | 102.38                       | -1.79  | do                    | 107.5            | 100.47                       |
| 103.    | do               | 97.0  | 98.0                          | 95.87                        | 91.5                           | 94.83                        | -1.61  | do                    | 89.0             | 91.75                        |
| 104.    | do               | 94.0  | 90.5                          | 96.27                        | 89.0                           | 94.68                        | -1.66  | do                    | 88.0             | 93.62                        |
| 105.    | do               | 106.0   | 99.5                          | 93.86                        | 98.0                           | 92.45                        | -1.51  | do                    | 96.5             | 91.04                        |
| 106.    | do               | 106.5   | 101.5                         | 96.21                        | 99.5                           | 94.31                        | -1.97  | do                    | 96.0             | 91.00                        |
| 107.    | do               | 95.0  | 93.5                          | 98.42                        | 91.0                           | 95.79                        | -2.67  | do                    | 88.5             | 93.16                        |
| 108.    | do               | 97.0  | 94.0                          | 96.91                        | 90.5                           | 93.29                        | -3.72  | do                    | 87.0             | 89.59                        |
| 109.    | do               | 105.0   | 99.0                          | 94.28                        | 97.0                           | 92.38                        | -2.02  | do                    | 93.5             | 89.06                        |

at 6 c. c. per gram.

[Brain weighed daily. Received June 13, 1906. Original weight, 103 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|--------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                    | Grams.           |                              |  |                    | Grams.           |                              |  |
| First              | 102.5            | 99.51                        | -0.49  | Twenty-eighth      | 96.5             | 93.69                        | -0.97  |
| Second             | 101.5            | 98.54                        | - .97  | Twenty-ninth       | 96.5             | 93.69                        | ± .00  |
| Third              | 101.5            | 98.54                        | ± .00  | Thirtieth          | 96.5             | 93.69                        | ± .00  |
| Fourth             | 100.0            | 97.08                        | -1.46  | Thirty-first       | 96.3             | 93.49                        | -.20   |
| Sixth              | 100.0            | 97.08                        | ± .00  | Thirty-second      | 96.0             | 93.20                        | -.29   |
| Seventh            | 100.0            | 97.08                        | ± .00  | Thirty-third       | 96.5             | 93.69                        | + .49  |
| Eighth             | 100.20           | 97.28                        | + .20  | Thirty-fourth      | 95.0             | 92.23                        | -.46   |
| Ninth              | 100.0            | 97.08                        | -.20   | Thirty-fifth       | 95.5             | 92.72                        | + .49  |
| Tenth              | 100.5            | 97.57                        | + .49  | Thirty-sixth       | 95.0             | 92.23                        | -.49   |
| Eleventh           | 99.5             | 96.60                        | - .97  | Thirty-seventh     | 95.5             | 92.72                        | + .49  |
| Twelfth            | 99.5             | 96.60                        | ± .00  | Thirty-eighth      | 95.5             | 92.72                        | ± .00  |
| Thirteenth         | 99.0             | 96.11                        | -.49   | Thirty-ninth       | 95.0             | 92.23                        | -.49   |
| Fourteenth         | 99.5             | 96.60                        | + .49  | Fortieth           | 95.5             | 92.72                        | + .49  |
| Fifteenth          | 98.5             | 95.63                        | - .97  | Forty-first        | 95.0             | 92.23                        | -.49   |
| Sixteenth          | 98.0             | 95.14                        | -.49   | Forty-second       | 95.5             | 92.72                        | + .49  |
| Seventeenth        | 97.5             | 94.66                        | ± .00  | Forty-third        | 95.5             | 92.72                        | ± .00  |
| Eighteenth         | 97.5             | 94.66                        | ± .00  | Forty-fourth       | 95.0             | 92.23                        | -.49   |
| Nineteenth         | 97.5             | 94.66                        | ± .00  | Forty-fifth        | 95.0             | 92.23                        | ± .00  |
| Twentieth          | 97.5             | 94.66                        | ± .00  | Forty-sixth        | 95.0             | 92.23                        | ± .00  |
| Twenty-first       | 98.0             | 95.14                        | + .48  | Forty-seventh      | 94.5             | 91.75                        | -.48   |
| Twenty-second      | 98.0             | 95.14                        | ± .00  | Forty-eighth       | 94.5             | 91.75                        | ± .00  |
| Twenty-third       | 97.5             | 94.66                        | -.48   | Forty-ninth        | 94.5             | 91.75                        | ± .00  |
| Twenty-fourth      | 97.5             | 94.66                        | ± .00  | Fiftieth           | 95.0             | 92.23                        | + .48  |
| Twenty-fifth       | 98.0             | 95.14                        | + .48  | Fifty-first        | 94.5             | 91.75                        | -.48   |
| Twenty-sixth       | 97.5             | 94.66                        | -.48   | Sixty-first        | 94.0             | 91.24                        | -.51   |
| Twenty-seventh     | 97.5             | 94.66                        | ± .00  | Sixty-eighth       | 92.5             | 89.81                        | -1.43  |

a Change of solution.

*Preservative: 1,015 sp. gr. salt solution with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1905.            | Grams.  | Grams.                        |                              | Grams.                         |                              |   | 1905.                 | Grams.           |                              |
| 131.    | June 16          | 102.0   | 104.5                         | 102.45                       | 103.0                          | 100.98                       | -1.43   | Aug. 16               | 98.5             | 96.57                        |
| 132.    | .....do          | 116.0   | 117.5                         | 101.29                       | 115.5                          | 99.57                        | -1.70   | .....do               | 110.5            | 95.26                        |
| 134a    | .....do          | 123.0   | 125.5                         | 102.03                       | 122.5                          | 99.60                        | -2.39   | .....do               | 117.0            | 95.12                        |

a At 6 c. c. per gram.

[Brain weighed daily. Received June 16, 1905. Original weight, 114 grams.]

| At the end of day.         | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day.  | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------------|------------------|------------------------------|--|---------------------|------------------|------------------------------|--|
|                            | Grams.           |                              |  |                     | Grams.           |                              |  |
| First .....                | 113.5            | 99.56                        | -0.44  | Twenty-eighth ..    | 112.5            | 98.68                        | +0.43  |
| Third .....                | 115.5            | 101.31                       | +1.75  | Twenty-ninth ...    | 112.0            | 98.25                        | - .43  |
| Fourth .....               | 116.0            | 101.75                       | + .44  | Thirtietha .....    | 112.0            | 98.25                        | ± .00  |
| Fifth .....                | 116.0            | 101.75                       | ± .00  | Thirty-first .....  | 112.0            | 98.25                        | ± .00  |
| Sixth .....                | 115.5            | 101.31                       | - .44  | Thirty-second ..... | 111.5            | 97.81                        | - .44  |
| Seventh <sup>a</sup> ..... | 115.5            | 101.31                       | ± .00  | Thirty-third .....  | 111.5            | 97.81                        | ± .00  |
| Eighth .....               | 116.0            | 101.75                       | + .44  | Thirty-fourth ..... | 111.0            | 97.37                        | - .44  |
| Ninth .....                | 116.0            | 101.75                       | ± .00  | Thirty-fifth .....  | 110.5            | 96.93                        | - .44  |
| Tenth .....                | 115.5            | 101.31                       | - .44  | Thirty-sixth .....  | 110.5            | 96.93                        | ± .00  |
| Eleventh .....             | 116.5            | 102.19                       | + .88  | Thirty-seventh ..   | 110.5            | 96.93                        | ± .00  |
| Twelfth .....              | 115.5            | 101.31                       | - .88  | Thirty-eighth ...   | 110.5            | 96.93                        | ± .00  |
| Thirteenth .....           | 114.8            | 100.70                       | - .61  | Thirty-ninth .....  | 110.5            | 96.93                        | + .00  |
| Fourteenth .....           | 114.5            | 100.44                       | - .26  | Fortieth .....      | 110.0            | 96.49                        | - .44  |
| Fifteenth .....            | 114.5            | 100.44                       | ± .00  | Forty-first .....   | 109.5            | 96.06                        | - .44  |
| Sixteenth .....            | 114.0            | 100.00                       | - .44  | Forty-second .....  | 109.5            | 96.06                        | ± .00  |
| Seventeenth .....          | 114.0            | 100.00                       | ± .00  | Forty-third .....   | 109.0            | 95.61                        | - .44  |
| Eighteenth .....           | 114.0            | 100.00                       | ± .00  | Forty-fourth .....  | 108.5            | 95.17                        | - .44  |
| Nineteenth .....           | 113.8            | 99.82                        | - .18  | Forty-fifth .....   | 108.0            | 94.73                        | - .44  |
| Twentieth .....            | 113.5            | 99.56                        | - .26  | Forty-sixth .....   | 108.0            | 94.73                        | + .00  |
| Twenty-first .....         | 113.5            | 99.56                        | ± .00  | Forty-seventh ..... | 108.5            | 95.17                        | + .44  |
| Twenty-second ..           | 113.5            | 99.56                        | + .00  | Forty-eighth .....  | 108.0            | 94.73                        | - .44  |
| Twenty-third .....         | 113.5            | 99.56                        | ± .00  | Forty-ninth .....   | 108.0            | 94.73                        | ± .00  |
| Twenty-fourth ..           | 113.0            | 99.12                        | - .44  | Fiftieth .....      | 108.0            | 94.73                        | ± .00  |
| Twenty-fifth .....         | 113.0            | 99.12                        | ± .00  | Fifty-first .....   | 107.5            | 94.29                        | - .44  |
| Twenty-sixth .....         | 112.5            | 98.68                        | - .44  | Sixty-first .....   | 106.5            | 93.42                        | - .87  |
| Twenty-seventh ..          | 112.0            | 98.25                        | - .43  | Sixty-eighth .....  | 106.0            | 92.98                        | - .44  |

a Change of solution.

*Preservative: Saturated solution of alum, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1905.            | Grams.  | Grams.                        |                              | Grams.                         |                              |   | 1905.                 | Grams.           |                              |
| 6.      | June 9           | 109.5   | 84.5                          | 77.17                        | 79.5                           | 72.60                        | - 5.92  | Aug. 9                | 78.0             | 71.23                        |
| 7.      | do               | 103.0   | 76.5                          | 74.27                        | 72.5                           | 70.39                        | - 5.23  | do                    | 71.0             | 68.93                        |
| 8.      | do               | 102.0   | 78.0                          | 76.09                        | 73.0                           | 71.22                        | - 6.41  | do                    | 71.5             | 69.75                        |
| 9.      | do               | 92.0  | 72.0                          | 78.26                        | 68.5                           | 74.45                        | - 4.86  | do                    | 66.0             | 71.74                        |
| 10.     | do               | 100.5   | 78.0                          | 77.61                        | 73.0                           | 72.63                        | - 6.41  | do                    | 71.5             | 71.14                        |
| 11.     | do               | 100.8   | 77.0                          | 76.38                        | 72.5                           | 71.92                        | - 5.84  | do                    | 71.5             | 70.93                        |
| 12.     | do               | 109.7   | 84.2                          | 76.75                        | 79.3                           | 72.29                        | - 5.82  | do                    | 78.5             | 71.56                        |
| 13.     | do               | 88.0  | 67.0                          | 76.13                        | 63.5                           | 72.16                        | - 5.22  | do                    | 63.0             | 71.59                        |
| 14.     | do               | 115.0   | 94.0                          | 81.74                        | 85.5                           | 74.35                        | - 9.04  | do                    | 83.5             | 72.61                        |
| 15.     | do               | 125.2   | 108.0                         | 82.26                        | 92.0                           | 73.48                        | -10.68  | do                    | 89.5             | 71.48                        |

a At 6 c. c. per gram.

[Brain weighed daily. Received June 9, 1905. Original weight, 101 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|--------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                    | Grams.           |                              |  |                    | Grams.           |                              |  |
| First              | 87.0             | 86.14                        | -13.86   | Twenty-ninth       | 71.5             | 70.79                        | ± 0.00   |
| Second             | 83.5             | 82.67                        | - 3.47   | Thirtieth          | 71.0             | 70.29                        | - .50  |
| Third              | 81.0             | 80.19                        | - 2.48   | Thirty-first       | 71.5             | 70.79                        | + .50  |
| Fourth             | 79.3             | 78.51                        | - 1.68   | Thirty-second      | 71.0             | 70.29                        | - .50  |
| Fifth              | 78.0             | 77.22                        | - 1.29   | Thirty-third       | 71.5             | 70.79                        | + .50  |
| Sixth              | 76.5             | 75.74                        | - 1.48   | Thirty-fourth      | 71.5             | 70.79                        | ± .00  |
| Seventh            | 75.0             | 74.25                        | - 1.49   | Thirty-fifth       | 71.5             | 70.79                        | ± .00  |
| Eighth             | 75.5             | 74.76                        | + .50  | Thirty-sixth       | 71.0             | 70.29                        | - .50  |
| Tenth              | 73.5             | 72.77                        | + 1.98   | Thirty-seventh     | 71.5             | 70.79                        | + .50  |
| Eleventh           | 73.5             | 72.77                        | - .00  | Thirty-eighth      | 71.5             | 70.79                        | ± .00  |
| Twelfth            | 73.0             | 72.27                        | - .50  | Thirty-ninth       | 71.3             | 70.59                        | - .20  |
| Thirteenth         | 72.8             | 72.08                        | - .19  | Fortieth           | 71.0             | 70.29                        | - .30  |
| Fourteenth         | 73.0             | 72.27                        | + .19  | Forty-first        | 71.0             | 70.29                        | ± .00  |
| Fifteenth          | 72.5             | 71.78                        | - .49  | Forty-second       | 71.5             | 70.79                        | + .50  |
| Sixteenth          | 73.0             | 72.27                        | + .49  | Forty-third        | 71.0             | 70.29                        | - .50  |
| Seventeenth        | 72.5             | 71.78                        | - .49  | Forty-fourth       | 71.0             | 70.29                        | ± .00  |
| Eighteenth         | 73.0             | 72.27                        | + .49  | Forty-fifth        | 71.0             | 70.29                        | ± .00  |
| Nineteenth         | 72.0             | 71.28                        | - .99  | Forty-sixth        | 71.0             | 70.29                        | ± .00  |
| Twentieth          | 71.5             | 70.79                        | - .49  | Forty-seventh      | 71.5             | 70.79                        | + .50  |
| Twenty-first       | 71.5             | 70.79                        | ± .00  | Forty-eighth       | 71.0             | 70.29                        | - .50  |
| Twenty-second      | 71.5             | 70.79                        | ± .00  | Forty-ninth        | 71.0             | 70.29                        | ± .00  |
| Twenty-third       | 71.7             | 70.99                        | + .20  | Fiftieth           | 71.0             | 70.29                        | ± .00  |
| Twenty-fourth      | 71.5             | 70.79                        | - .20  | Fifty-first        | 70.5             | 69.80                        | - .49  |
| Twenty-fifth       | 71.8             | 71.09                        | + .30  | Sixty-first        | 70.0             | 69.31                        | - .49  |
| Twenty-sixth       | 71.5             | 70.79                        | - .30  | Sixty-eighth       | 69.5             | 68.81                        | - .50  |
| Twenty-seventh     | 72.0             | 71.28                        | + .49  | Seventy-fifth      | 69.5             | 68.81                        | ± .00  |
| Twenty-eighth      | 71.5             | 70.79                        | - .49  |                    |                  |                              |  |

a Change of solution.

*Preservative: One-third saturated solution of alum, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  | Grams.  | Grams.                        |                              | Grams.                         |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
| 89.     | 1905. June 12    | 106.0   | 106.5                         | 100.47                       | 96.5                           | 91.04                        | - 9.39  | 1905. Aug. 12         | 90.5             | 85.38                        |
| 90.     | .....do.....     | 97.0  | 97.5                          | 100.51                       | 86.5                           | 89.17                        | - 11.27   | .....do.....          | 79.0             | 81.44                        |
| 91.     | 1905. June 13    | 116.5   | 114.0                         | 97.85                        | 107.0                          | 91.84                        | - 6.14  | 1905. Aug. 13         | 101.0            | 86.69                        |
| 92.     | .....do.....     | 105.5   | 104.0                         | 98.57                        | 99.3                           | 94.12                        | - 4.52  | .....do.....          | 95.0             | 90.05                        |
| 93.     | .....do.....     | 116.0   | 113.0                         | 97.41                        | 106.5                          | 91.81                        | - 5.75  | .....do.....          | 100.0            | 86.21                        |
| 94.     | .....do.....     | 120.0   | 120.5                         | 100.42                       | 115.5                          | 96.25                        | - 4.15  | .....do.....          | 109.0            | 90.83                        |
| 95.     | .....do.....     | 113.0   | 112.5                         | 99.55                        | 107.0                          | 94.69                        | - 4.89  | .....do.....          | 103.5            | 91.59                        |
| 96.     | .....do.....     | 110.0   | 111.0                         | 100.90                       | 105.8                          | 96.18                        | - 4.68  | .....do.....          | 99.5             | 90.45                        |
| 97.     | .....do.....     | 103.0   | 101.5                         | 98.54                        | 96.5                           | 93.69                        | - 4.92  | .....do.....          | 92.0             | 89.32                        |
| 98.     | .....do.....     | 122.0   | 119.5                         | 97.95                        | 113.0                          | 92.62                        | - 5.44  | .....do.....          | 108.5            | 88.93                        |

<sup>a</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 13, 1905. Original weight, 108 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|--------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                    | Grams.           |                              |  |                    | Grams.           |                              |  |
| First.....         | 112.0            | 103.70                       | - 3.70   | Twenty-eighth..    | 92.0             | 85.19                        | - 0.46   |
| Second.....        | 110.0            | 101.85                       | - 1.85   | Twenty-ninth...    | 92.5             | 85.65                        | + .46  |
| Third.....         | 108.5            | 100.46                       | - 1.39   | Thirtieth.....     | 92.0             | 85.19                        | - .46  |
| Fourth.....        | 108.0            | 100.00                       | - .46  | Thirty-first.....  | 90.5             | 83.79                        | - 1.40   |
| Sixth.....         | 105.0            | 97.22                        | - 2.78   | Thirty-second...   | 90.0             | 83.33                        | - .46  |
| Seventh.....       | 103.5            | 95.83                        | - 1.39   | Thirty-third.....  | 90.0             | 83.33                        | + .00  |
| Eighth.....        | 103.0            | 95.37                        | - .46  | Thirty-fourth....  | 89.5             | 82.87                        | - .46  |
| Ninth.....         | 102.5            | 94.91                        | - .46  | Thirty-fifth.....  | 89.0             | 82.41                        | - .46  |
| Tenth.....         | 101.5            | 93.98                        | - .93  | Thirty-sixth.....  | 88.5             | 81.94                        | - .47  |
| Eleventh.....      | 100.0            | 92.59                        | - 1.39   | Thirty-seventh...  | 88.5             | 81.94                        | + .00  |
| Twelfth.....       | 100.2            | 92.78                        | + .19  | Thirty-eighth....  | 88.5             | 81.94                        | + .00  |
| Thirteenth...      | 98.5             | 91.20                        | - 1.58   | Thirty-ninth....   | 88.0             | 81.48                        | - .46  |
| Fourteenth...      | 97.5             | 90.28                        | - .92  | Fortieth.....      | 87.5             | 81.02                        | - .46  |
| Fifteenth.....     | 97.5             | 90.28                        | + .00  | Forty-first.....   | 87.3             | 80.88                        | - .19  |
| Sixteenth.....     | 97.5             | 90.28                        | + .00  | Forty-second....   | 87.0             | 80.55                        | - .28  |
| Seventeenth...     | 96.6             | 89.44                        | - .84  | Forty-third.....   | 87.0             | 80.55                        | + .00  |
| Eighteenth...      | 95.5             | 88.42                        | - 1.02   | Forty-fourth....   | 86.5             | 80.09                        | - .46  |
| Nineteenth...      | 95.5             | 88.42                        | + .00  | Forty-fifth.....   | 86.5             | 80.09                        | + .00  |
| Twentieth.....     | 95.0             | 87.96                        | - .46  | Forty-sixth.....   | 86.5             | 80.09                        | + .00  |
| Twenty-first...    | 94.2             | 87.22                        | - .74  | Forty-seventh...   | 86.0             | 79.68                        | - .46  |
| Twenty-second      | 94.0             | 87.04                        | - .18  | Forty-eighth....   | 86.0             | 79.68                        | + .00  |
| Twenty-third...    | 94.0             | 87.04                        | + .00  | Forty-ninth.....   | 86.0             | 79.68                        | + .00  |
| Twenty-fourth...   | 94.0             | 87.04                        | + .00  | Fiftieth.....      | 86.0             | 79.68                        | + .00  |
| Twenty-fifth...    | 93.5             | 86.57                        | - .47  | Fifty-first.....   | 86.0             | 79.68                        | + .00  |
| Twenty-sixth...    | 93.5             | 86.57                        | + .00  | Sixty-first.....   | 85.5             | 79.17                        | - .46  |
| Twenty-seventh     | 92.5             | 85.65                        | - .92  | Sixty-eighth....   | 84.0             | 77.78                        | - 1.39   |

<sup>a</sup> Change of solution.

*Preservative: One-fifth saturated solution of alum, with 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1905.            | Grams.  | Grams.                        |                              | Grams.                         |                              |   | 1905.                 | Grams.           |                              |
| 111.    | June 13          | 99.0  | 102.0                         | 103.03                       | 94.5                           | 95.45                        | - 7.35  | Aug. 13               | 82.0             | 82.82                        |
| 113.    | June 16          | 108.5   | 109.5                         | 100.92                       | 100.5                          | 92.62                        | - 8.22  | Aug. 16               | 92.5             | 85.25                        |
| 114.    | do               | 108.0   | 111.0                         | 102.78                       | 101.5                          | 93.98                        | - 8.56  | do                    | 95.5             | 88.42                        |
| 115.    | do               | 96.0  | 99.0                          | 103.12                       | 90.5                           | 94.27                        | - 8.58  | do                    | 83.0             | 86.46                        |
| 116.    | do               | 116.0   | 116.5                         | 100.43                       | 106.5                          | 91.81                        | - 8.58  | do                    | 99.0             | 85.34                        |
| 117.    | do               | 108.5   | 108.5                         | 100.00                       | 99.0                           | 91.24                        | - 8.75  | do                    | 94.5             | 87.09                        |
| 118.    | do               | 115.0   | 116.0                         | 100.87                       | 105.5                          | 91.74                        | - 9.05  | do                    | 98.5             | 85.65                        |
| 119.    | do               | 109.5   | 108.5                         | 99.09                        | 98.5                           | 89.95                        | - 9.21  | do                    | 92.5             | 84.47                        |
| 120.    | do               | 112.5   | 113.0                         | 100.44                       | 98.5                           | 87.56                        | - 12.83   | do                    | 92.0             | 81.77                        |
| 121.    | do               | 126.0   | 124.0                         | 98.41                        | 114.5                          | 90.88                        | - 7.66  | do                    | 106.0            | 84.13                        |

♂ At 6 c. c. per gram.

[Brain weighed daily. Received June 13, 1905. Original weight, 100.2 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|--------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                    | Grams.           |                              |  |                    | Grams.           |                              |  |
| First              | 108.5            | 103.29                       | +3.29  | Twenty-eighth      | 92.5             | 92.31                        | -0.50  |
| Second             | 106.5            | 105.28                       | +1.99  | Twenty-ninth       | 92.5             | 92.31                        | +1.00  |
| Third              | 106.5            | 105.97                       | + .69  | Thirtieth          | 92.5             | 92.31                        | +1.00  |
| Fourth             | 104.3            | 103.78                       | -2.19  | Thirty-first       | 91.5             | 91.31                        | -1.00  |
| Sixth              | 103.2            | 102.78                       | -1.00  | Thirty-second      | 90.0             | 89.82                        | -1.49  |
| Seventh            | 102.5            | 101.99                       | - .79  | Thirty-third       | 89.5             | 89.31                        | - .51  |
| Eighth             | 102.5            | 101.99                       | + .00  | Thirty-fourth      | 88.5             | 88.32                        | - .99  |
| Ninth              | 101.5            | 101.29                       | - .70  | Thirty-fifth       | 88.0             | 87.82                        | - .50  |
| Tenth              | 101.0            | 100.79                       | - .50  | Thirty-sixth       | 88.0             | 87.82                        | + .00  |
| Eleventh           | 100.5            | 100.29                       | - .50  | Thirty-seventh     | 87.0             | 86.82                        | -1.00  |
| Twelfth            | 100.0            | 99.80                        | - .49  | Thirty-eighth      | 87.0             | 86.82                        | + .00  |
| Thirteenth         | 99.0             | 98.80                        | -1.00  | Thirty-ninth       | 86.5             | 86.32                        | - .50  |
| Fourteenth         | 98.5             | 98.30                        | - .50  | Fortieth           | 86.5             | 86.32                        | + .00  |
| Fifteenth          | 98.0             | 97.80                        | - .50  | Forty-first        | 86.5             | 86.32                        | + .00  |
| Sixteenth          | 97.5             | 97.31                        | - .49  | Forty-second       | 85.5             | 85.32                        | -1.00  |
| Seventeenth        | 97.0             | 96.81                        | - .50  | Forty-third        | 85.5             | 85.32                        | + .00  |
| Eighteenth         | 96.0             | 95.81                        | -1.00  | Forty-fourth       | 85.0             | 84.83                        | - .49  |
| Nineteenth         | 96.0             | 95.81                        | + .00  | Forty-fifth        | 84.5             | 84.33                        | - .50  |
| Twentieth          | 95.5             | 95.31                        | - .50  | Forty-sixth        | 84.0             | 83.83                        | + .50  |
| Twenty-first       | 95.2             | 95.01                        | - .30  | Forty-seventh      | 84.0             | 83.83                        | + .00  |
| Twenty-second      | 95.2             | 95.01                        | + .00  | Forty-eighth       | 83.5             | 83.33                        | - .50  |
| Twenty-third       | 94.5             | 94.31                        | - .70  | Forty-ninth        | 83.5             | 83.33                        | + .00  |
| Twenty-fourth      | 94.5             | 94.31                        | + .00  | Fiftieth           | 84.0             | 83.83                        | + .50  |
| Twenty-fifth       | 93.5             | 93.31                        | -1.00  | Fifty-first        | 83.5             | 83.33                        | - .50  |
| Twenty-sixth       | 93.5             | 93.31                        | + .00  | Sixty-first        | 83.0             | 82.83                        | -1.00  |
| Twenty-seventh     | 93.0             | 92.81                        | - .50  | Sixty-eighth       | 81.5             | 81.33                        | -1.50  |

♂ Change of solution.

*Preservative: One-third saturated solution of alum, sodium chloride up to 1,030 sp. gr., with 10 per cent formalin.*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1905.            | Grams.  | Grams.                        |                              | Grams.                         |                              |   | 1905.                 | Grams.           |                              |
| 78...   | June 12          | 108.0   | 98.0                          | 90.74                        | 85.0                           | 78.70                        | -13.26  | Aug. 12               | 77.5             | 71.76                        |
| 79..... | do               | 115.2   | 105.0                         | 92.01                        | 99.0                           | 85.94                        | -5.60   | do                    | 94.5             | 82.03                        |
| 80..... | do               | 108.0   | 99.0                          | 91.66                        | 86.5                           | 80.49                        | -12.62  | do                    | 78.0             | 72.22                        |
| 81..... | do               | 111.5   | 102.0                         | 91.48                        | 91.5                           | 82.06                        | -10.29  | do                    | 81.5             | 73.09                        |
| 82..... | do               | 104.0   | 94.5                          | 90.86                        | 83.0                           | 79.81                        | -12.17  | do                    | 73.5             | 70.67                        |
| 83..... | do               | 101.0   | 91.5                          | 90.59                        | 79.5                           | 78.71                        | -13.11  | do                    | 71.5             | 70.79                        |
| 84..... | do               | 113.0   | 102.0                         | 90.26                        | 89.0                           | 78.76                        | -12.74  | do                    | 80.5             | 71.24                        |
| 85..... | do               | 95.5  | 90.5                          | 94.76                        | 78.0                           | 81.67                        | -13.81  | do                    | 69.5             | 72.77                        |
| 86..... | do               | 100.5   | 97.5                          | 97.01                        | 85.0                           | 84.57                        | -12.82  | do                    | 76.5             | 76.12                        |
| 87..... | do               | 115.5   | 108.5                         | 93.94                        | 96.0                           | 83.12                        | -11.52  | do                    | 85.5             | 74.08                        |

<sup>a</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 12, 1905. Original weight, 105 grams.]

| At the end of day.         | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day.           | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------------|------------------|------------------------------|--|------------------------------|------------------|------------------------------|--|
|                            | Grams.           |                              |  |                              | Grams.           |                              |  |
| First.....                 | 102.5            | 97.62                        | -2.38  | Twenty-ninth...              | 88.0             | 79.06                        | +0.47  |
| Second.....                | 98.5             | 93.81                        | -3.81  | Thirtieth <sup>a</sup> ..... | 82.5             | 78.57                        | - .48  |
| Third.....                 | 98.4             | 93.71                        | - .10  | Thirty-first.....            | 82.0             | 78.09                        | - .48  |
| Fourth.....                | 98.0             | 93.33                        | - .38  | Thirty-second.....           | 81.5             | 77.62                        | - .48  |
| Fifth.....                 | 95.5             | 90.95                        | -2.38  | Thirty-third.....            | 81.5             | 77.62                        | + .00  |
| Seventh <sup>a</sup> ..... | 93.5             | 89.06                        | -1.90  | Thirty-fourth.....           | 81.5             | 77.62                        | + .00  |
| Eighth.....                | 92.0             | 87.62                        | -1.43  | Thirty-fifth.....            | 80.0             | 76.19                        | -1.43  |
| Ninth.....                 | 92.0             | 87.62                        | ± .00  | Thirty-sixth.....            | 80.0             | 76.19                        | + .00  |
| Tenth.....                 | 91.5             | 87.14                        | - .48  | Thirty-seventh.....          | 80.0             | 76.19                        | + .00  |
| Eleventh.....              | 91.0             | 86.67                        | - .47  | Thirty-eighth.....           | 80.0             | 76.19                        | + .00  |
| Twelfth.....               | 89.5             | 85.23                        | -1.44  | Thirty-ninth.....            | 80.0             | 76.19                        | ± .00  |
| Thirteenth.....            | 89.5             | 85.23                        | ± .00  | Fortieth.....                | 79.5             | 75.71                        | - .48  |
| Fourteenth.....            | 89.0             | 84.76                        | - .47  | Forty-first.....             | 79.0             | 75.23                        | - .48  |
| Fifteenth.....             | 88.5             | 84.28                        | - .48  | Forty-second.....            | 79.0             | 75.23                        | ± .00  |
| Sixteenth.....             | 88.0             | 83.81                        | - .47  | Forty-third.....             | 79.0             | 75.23                        | + .00  |
| Seventeenth.....           | 86.5             | 82.38                        | -1.43  | Forty-fourth.....            | 79.0             | 75.23                        | ± .00  |
| Eighteenth.....            | 86.5             | 82.38                        | ± .00  | Forty-fifth.....             | 78.5             | 74.76                        | - .47  |
| Nineteenth.....            | 86.0             | 81.90                        | - .48  | Forty-sixth.....             | 78.0             | 74.28                        | - .48  |
| Twentieth.....             | 85.5             | 81.43                        | - .47  | Forty-seventh.....           | 77.5             | 73.81                        | - .47  |
| Twenty-first.....          | 85.0             | 80.95                        | - .48  | Forty-eighth.....            | 77.0             | 73.33                        | - .48  |
| Twenty-second.....         | 84.5             | 80.47                        | - .48  | Forty-ninth.....             | 77.5             | 73.81                        | + .48  |
| Twenty-third.....          | 84.5             | 80.47                        | + .00  | Fiftieth.....                | 77.5             | 73.81                        | ± .00  |
| Twenty-fourth.....         | 83.5             | 79.52                        | - .95  | Fifty-first.....             | 77.5             | 73.81                        | ± .00  |
| Twenty-fifth.....          | 84.0             | 80.00                        | + .48  | Sixty-first.....             | 77.0             | 73.33                        | - .48  |
| Twenty-sixth.....          | 83.5             | 79.52                        | - .48  | Sixty-seventh.....           | 76.0             | 72.38                        | - .95  |
| Twenty-seventh.....        | 82.5             | 78.57                        | - .95  | Seventy-fourth.....          | 76.0             | 72.38                        | ± .00  |
| Twenty-eighth.....         | 82.5             | 78.57                        | ± .00  |                              |                  |                              |  |

<sup>a</sup> Change of solution.

*Preservative: One-third saturated solution of alum, with salt up to 1,030 sp. gr.; 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1905.            | Grams.  | Grams.                        |                              | Grams.                         |                              |   | 1905.                 | Grams.           |                              |
| 67.     | June 10          | 123.0   | 128.0                         | 104.06                       | 110.5                          | 89.84                        | -13.67  | Aug. 10               | 94.0             | 76.42                        |
| 68.     | June 12          | 114.0   | 114.5                         | 100.44                       | 95.0                           | 83.33                        | -17.08  | Aug. 12               | 87.0             | 76.31                        |
| 69.     | do               | 104.5   | 107.0                         | 102.37                       | 88.5                           | 84.69                        | -17.29  | do                    | 78.0             | 74.64                        |
| 70.     | do               | 99.8  | 101.5                         | 101.70                       | 84.0                           | 84.16                        | -17.24  | do                    | 75.5             | 75.65                        |
| 71.     | do               | 104.5   | 107.0                         | 102.37                       | 84.4                           | 81.72                        | -21.12  | do                    | 76.0             | 72.73                        |
| 72.     | do               | 109.5   | 110.5                         | 100.91                       | 92.0                           | 84.02                        | -16.74  | do                    | 82.0             | 74.88                        |
| 73.     | do               | 97.5  | 101.0                         | 103.58                       | 83.0                           | 85.13                        | -17.82  | do                    | 76.0             | 77.95                        |
| 74.     | do               | 110.8   | 113.5                         | 102.43                       | 97.5                           | 87.99                        | -14.09  | do                    | 90.5             | 81.68                        |
| 75.     | do               | 98.0  | 102.0                         | 104.08                       | 87.5                           | 89.28                        | -14.21  | do                    | 75.0             | 76.58                        |
| 75a.    | do               | 120.5   | 118.5                         | 98.34                        | 106.5                          | 88.38                        | -10.13  | do                    | 101.5            | 84.23                        |

<sup>a</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 12, 1905. Original weight, 108 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|--------------------|------------------|------------------------------|--|--------------------|------------------|------------------------------|--|
|                    | Grams.           |                              |  |                    | Grams.           |                              |  |
| First              | 107.0            | 99.08                        | -0.92  | Twenty-ninth       | 93.0             | 86.11                        | +0.00  |
| Second             | 106.0            | 98.15                        | - .93  | Thirtieth          | 93.5             | 86.57                        | + .46  |
| Third              | 105.5            | 97.68                        | - .47  | Thirty-first       | 91.5             | 84.72                        | -1.85  |
| Fourth             | 105.0            | 97.22                        | - .46  | Thirty-second      | 91.0             | 84.26                        | - .46  |
| Fifth              | 105.5            | 97.68                        | + .46  | Thirty-third       | 90.5             | 83.79                        | - .47  |
| Seventh            | 103.0            | 95.37                        | -2.31  | Thirty-fourth      | 90.5             | 83.79                        | + .00  |
| Eighth             | 102.7            | 95.09                        | - .28  | Thirty-fifth       | 89.5             | 82.87                        | - .92  |
| Ninth              | 100.5            | 93.05                        | -2.04  | Thirty-sixth       | 89.5             | 82.87                        | + .00  |
| Tenth              | 100.5            | 93.05                        | ± .00  | Thirty-seventh     | 89.5             | 82.87                        | + .00  |
| Eleventh           | 100.5            | 93.05                        | ± .00  | Thirty-eighth      | 89.0             | 82.41                        | - .46  |
| Twelfth            | 100.0            | 92.59                        | - .46  | Thirty-ninth       | 88.5             | 81.94                        | - .47  |
| Thirteenth         | 99.0             | 91.67                        | - .92  | Fortieth           | 89.0             | 82.41                        | + .47  |
| Fourteenth         | 99.5             | 91.20                        | - .47  | Forty-first        | 89.0             | 82.41                        | + .00  |
| Fifteenth          | 97.0             | 89.81                        | -1.39  | Forty-second       | 89.5             | 82.87                        | + .46  |
| Sixteenth          | 96.8             | 89.63                        | - .18  | Forty-third        | 89.0             | 82.41                        | - .46  |
| Seventeenth        | 96.5             | 88.42                        | -1.21  | Forty-fourth       | 89.0             | 82.41                        | + .00  |
| Eighteenth         | 96.0             | 88.89                        | + .47  | Forty-fifth        | 87.5             | 81.02                        | -1.39  |
| Nineteenth         | 96.5             | 89.35                        | + .46  | Forty-sixth        | 88.0             | 81.48                        | + .46  |
| Twentieth          | 95.8             | 88.70                        | - .65  | Forty-seventh      | 87.5             | 81.02                        | - .46  |
| Twenty-first       | 95.5             | 88.42                        | - .28  | Forty-eighth       | 88.0             | 81.48                        | + .46  |
| Twenty-second      | 95.0             | 87.96                        | - .46  | Forty-ninth        | 87.5             | 81.02                        | - .46  |
| Twenty-third       | 95.0             | 87.96                        | ± .00  | Fiftieth           | 87.5             | 81.02                        | + .00  |
| Twenty-fourth      | 94.5             | 87.50                        | - .46  | Fifty-first        | 88.0             | 81.48                        | + .46  |
| Twenty-fifth       | 94.3             | 87.31                        | - .19  | Sixty-first        | 87.5             | 81.02                        | - .46  |
| Twenty-sixth       | 94.0             | 87.03                        | - .28  | Sixty-seventh      | 86.5             | 80.09                        | - .93  |
| Twenty-seventh     | 93.0             | 86.11                        | - .92  | Seventy-fourth     | 86.0             | 79.63                        | - .46  |
| Twenty-eighth      | 93.0             | 86.11                        | ± .00  |                    |                  |                              |  |

<sup>a</sup> Change of solution.

*Preservative: Eighty parts of 95 per cent alcohol and 20 parts of 5 per cent formalin (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  | Grams.  | Grams.                        |                              | Grams.                         |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
| 123.    | 1905. June 16    | 102.0   | a 90.5                        | 88.72                        | a 89.8                         | 88.04                        | -0.77   | 1905. Aug. 16         | 90.5             | 88.72                        |
| 124.    | do               | 117.0   | a 107.0                       | 91.45                        | a 104.5                        | 89.31                        | -2.34   | do                    | 105.0            | 89.74                        |
| 126.    | do               | 112.0   | a 95.5                        | 85.27                        | a 93.5                         | 83.48                        | -2.09   | do                    | 92.5             | 82.59                        |
| 125b    | do               | 106.0   | a 90.0                        | 84.90                        | a 88.5                         | 83.49                        | -1.66   | do                    | 87.0             | 82.07                        |

a Solution not changed.

b At 6 c. c. per gram.

[Brain weighed daily. Received June 16, 1905. Original weight, 109 grams.]

| At the end of day.   | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day.     | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------|------------------|------------------------------|--|------------------------|------------------|------------------------------|--|
|                      | Grams.           |                              |  |                        | Grams.           |                              |  |
| First                | 106.0            | 97.25                        | -2.75  | Twenty-eighth          | 94.0             | 86.24                        | -0.15  |
| Third                | 100.6            | 92.29                        | -4.96  | Twenty-ninth           | 94.0             | 86.24                        | + .00  |
| Fourth               | 98.5             | 90.36                        | -1.93  | Thirtieth <sup>a</sup> | 95.0             | 87.15                        | + .91  |
| Fifth                | 97.0             | 88.99                        | -1.37  | Thirty-first           | 94.5             | 86.69                        | -.46   |
| Sixth                | 95.8             | 87.89                        | -1.10  | Thirty-second          | 92.5             | 84.86                        | -1.83  |
| Seventh <sup>a</sup> | 96.5             | 88.53                        | + .64  | Thirty-third           | 91.0             | 83.48                        | -1.38  |
| Eighth               | 95.5             | 87.61                        | -.92   | Thirty-fourth          | 91.5             | 83.94                        | + .46  |
| Ninth                | 94.5             | 86.69                        | -.92   | Thirty-fifth           | 91.0             | 83.48                        | -.46   |
| Tenth                | 94.5             | 86.69                        | + .00  | Thirty-six             | 91.0             | 83.48                        | + .00  |
| Eleventh             | 95.0             | 87.15                        | + .46  | Thirty-seventh         | 91.5             | 83.94                        | -.46   |
| Twelfth              | 93.5             | 85.78                        | -1.37  | Thirty-eighth          | 91.0             | 83.48                        | -.46   |
| Thirteenth           | 93.0             | 85.32                        | -.46   | Thirty-ninth           | 91.0             | 83.48                        | + .00  |
| Fourteenth           | 93.5             | 85.78                        | +.46   | Fortieth               | 91.0             | 83.48                        | + .00  |
| Fifteenth            | 93.0             | 85.32                        | -.46   | Forty-first            | 91.0             | 83.48                        | + .00  |
| Sixteenth            | 93.5             | 85.78                        | + .46  | Forty-second           | 91.0             | 83.48                        | + .00  |
| Seventeenth          | 93.0             | 85.32                        | -.46   | Forty-third            | 91.0             | 83.48                        | + .00  |
| Eighteenth           | 93.5             | 85.78                        | + .46  | Forty-fourth           | 90.5             | 83.03                        | -.45   |
| Nineteenth           | 93.5             | 85.78                        | + .00  | Forty-fifth            | 90.5             | 83.03                        | + .00  |
| Twentieth            | 94.0             | 86.24                        | + .46  | Forty-sixth            | 90.5             | 83.03                        | + .00  |
| Twenty-first         | 93.5             | 85.78                        | -.46   | Forty-seventh          | 90.5             | 83.03                        | + .00  |
| Twenty-second        | 94.0             | 86.24                        | + .46  | Forty-eighth           | 90.5             | 83.03                        | + .00  |
| Twenty-third         | 94.0             | 86.24                        | + .00  | Forty-ninth            | 90.5             | 83.03                        | + .00  |
| Twenty-fourth        | 93.5             | 85.78                        | -.46   | Fiftieth               | 90.5             | 83.03                        | + .00  |
| Twenty-fifth         | 93.5             | 85.78                        | + .00  | Fifty-first            | 90.5             | 83.03                        | + .00  |
| Twenty-sixth         | 94.0             | 86.24                        | + .46  | Sixty-first            | 90.5             | 83.03                        | + .00  |
| Twenty-seventh       | 94.5             | 86.69                        | + .45  | Sixty-fifth            | 90.5             | 83.03                        | + .00  |

<sup>a</sup> Change of solution.

*Preservative: Sixty-five parts of 95 per cent alcohol and 35 parts of 3 per cent formalin.*

[Condition of brain: Medium.]

| Number. | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|---------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|         |                  |   |                               |                              |                                |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
|         | 1905.            | <i>Grams.</i>                                 | <i>Grams.</i>                 |                              | <i>Grams.</i>                  |                              |   | Aug. 16               | <i>Grams.</i>    |                              |
| 128     | June 16          | 93.5  | a 89.5                        | 95.72                        | a 89.0                         | 95.18                        | -0.50   | Aug. 16               | 89.0             | 95.18                        |
| 129     | .....do.....     | 96.5  | a 92.5                        | 96.86                        | a 92.0                         | 96.34                        | -0.54   | .....do.....          | 92.5             | 96.86                        |
| 130     | .....do.....     | 112.0   | a 101.0                       | 90.18                        | a 98.5                         | 87.95                        | -2.47   | .....do.....          | 99.0             | 88.39                        |

a Solution not changed.

b At 6 c. c. per gram.

[Brain weighed daily. Received June 16, 1905. Original weight, 96 grams.]

| At the end of day. | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day.  | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|--------------------|------------------|------------------------------|--|---------------------|------------------|------------------------------|--|
|                    | <i>Grams.</i>    |                              |  |                     | <i>Grams.</i>    |                              |  |
| First .....        | 97.5             | 101.56                       | +1.56  | Twenty-eighth ..    | 91.5             | 95.31                        | ±0.00  |
| Third .....        | 94.0             | 97.91                        | -3.65  | Twenty-ninth ...    | 91.5             | 95.31                        | ±.00   |
| Fourth .....       | 92.5             | 96.35                        | -1.66  | Thirtieth .....     | 92.0             | 95.83                        | + .52  |
| Fifth .....        | 92.5             | 96.35                        | ±.00   | Thirty-first a ..   | 91.5             | 95.31                        | - .52  |
| Sixth .....        | 92.0             | 95.83                        | - .52  | Thirty-second ..    | 91.5             | 95.31                        | ±.00   |
| Seventh .....      | 91.5             | 95.31                        | - .52  | Thirty-third .....  | 91.5             | 95.31                        | ±.00   |
| Eighth a .....     | 91.5             | 95.31                        | ±.00   | Thirty-fourth ..... | 91.0             | 94.79                        | - .52  |
| Ninth .....        | 91.7             | 95.52                        | + .21  | Thirty-fifth .....  | 91.5             | 95.31                        | + .52  |
| Tenth .....        | 91.5             | 95.31                        | - .21  | Thirty-sixth .....  | 91.5             | 95.31                        | ±.00   |
| Eleventh .....     | 92.0             | 95.83                        | + .52  | Thirty-seventh ..   | 91.5             | 95.31                        | ±.00   |
| Twelfth .....      | 91.5             | 95.31                        | - .52  | Thirty-eighth ..    | 91.0             | 94.79                        | - .52  |
| Thirteenth .....   | 91.0             | 94.79                        | - .52  | Thirty-ninth .....  | 91.0             | 94.79                        | ±.00   |
| Fourteenth .....   | 91.5             | 95.31                        | + .52  | Fortieth .....      | 91.5             | 95.31                        | + .52  |
| Fifteenth .....    | 91.0             | 94.79                        | - .52  | Forty-first .....   | 91.0             | 94.79                        | - .52  |
| Sixteenth .....    | 91.0             | 94.79                        | ±.00   | Forty-second .....  | 91.0             | 94.79                        | ±.00   |
| Seventeenth .....  | 91.5             | 95.31                        | + .52  | Forty-third .....   | 91.0             | 94.79                        | ±.00   |
| Eighteenth .....   | 91.0             | 94.79                        | - .52  | Forty-fourth .....  | 91.0             | 94.79                        | ±.00   |
| Nineteenth .....   | 91.5             | 95.31                        | + .52  | Forty-fifth .....   | 91.5             | 95.31                        | + .52  |
| Twentieth .....    | 91.5             | 95.31                        | ±.00   | Forty-sixth .....   | 91.5             | 95.31                        | ±.00   |
| Twenty-first ..... | 91.5             | 95.31                        | ±.00   | Forty-seventh ..    | 91.0             | 94.79                        | - .52  |
| Twenty-second ..   | 91.5             | 95.31                        | ±.00   | Forty-eighth .....  | 91.0             | 94.79                        | ±.00   |
| Twenty-third ..... | 91.8             | 95.63                        | + .32  | Forty-ninth .....   | 91.0             | 94.79                        | ±.00   |
| Twenty-fourth ..   | 91.0             | 94.79                        | - .84  | Fiftieth .....      | 91.0             | 94.79                        | ±.00   |
| Twenty-fifth ..... | 91.5             | 95.31                        | + .52  | Fifty-first .....   | 91.0             | 94.79                        | ±.00   |
| Twenty-sixth ..... | 91.5             | 95.31                        | ±.00   | Sixty-first .....   | 91.5             | 95.31                        | + .52  |
| Twenty-seventh ..  | 91.5             | 95.31                        | ±.00   | Sixty-seventh ...   | 91.0             | 94.79                        | - .52  |

a Change of solution.

*Sodium acetate (fused) 130 grams; sodium chloride, 110 grams; formalin, 20 c. c.; 95 per cent alcohol, 460 c. c.; water, 540 c. c. (3 c. c. per gram).*

[Condition of brain: Medium.]

| Number.            | Date of autopsy. | Weight of brain immediately after extraction. | Weight of brain after 1 week. | Per cent of original weight. | Weight of brain after 1 month. | Per cent of original weight. | Per cent of change between the end of first and end of fourth week. | Additional weighings. |                  |                              |
|--------------------|------------------|---|-------------------------------|------------------------------|--------------------------------|------------------------------|---|-----------------------|------------------|------------------------------|
|                    |                  | Grams.  | Grams.                        |                              | Grams.                         |                              |   | Date.                 | Weight of brain. | Per cent of original weight. |
| 135.               | 1905, June 27    | 118.2   | a 102.5                       | 86.72                        | a 102.5                        | 86.72                        | +0.00   | 1905, Aug. 27         | 102.5            | 86.72                        |
| 136.               | .....do.....     | 111.0   | a 98.5                        | 88.40                        | a 99.0                         | 86.84                        | + .51   | .....do.....          | 98.5             | 86.40                        |
| 137.               | .....do.....     | 101.0   | a 86.5                        | 85.64                        | a 87.5                         | 86.63                        | +1.15   | .....do.....          | 87.0             | 86.13                        |
| 139.               | .....do.....     | 114.5   | a 98.5                        | 86.02                        | a 99.5                         | 86.90                        | +1.01   | .....do.....          | 99.5             | 86.90                        |
| 140.               | .....do.....     | 115.2   | a 99.0                        | 85.93                        | a 99.5                         | 86.37                        | + .51   | .....do.....          | 99.0             | 85.93                        |
| 141.               | .....do.....     | 105.7   | a 90.5                        | 85.62                        | a 91.0                         | 86.09                        | + .55   | .....do.....          | 91.5             | 86.56                        |
| 142.               | .....do.....     | 82.0  | a 70.0                        | 85.36                        | a 70.5                         | 85.97                        | + .71   | .....do.....          | 70.5             | 85.97                        |
| 143.               | .....do.....     | 103.5   | a 87.5                        | 84.54                        | a 88.5                         | 85.51                        | +1.14   | .....do.....          | 88.5             | 85.51                        |
| 144.               | .....do.....     | 103.0   | a 89.5                        | 86.89                        | a 90.0                         | 87.38                        | + .56   | .....do.....          | 90.0             | 87.38                        |
| 145 <sup>b</sup> . | .....do.....     | 110.0   | 93.5                          | 85.00                        | 94.0                           | 85.45                        | + .53   | .....do.....          | 94.0             | 85.45                        |

<sup>a</sup> Solution not changed.

<sup>b</sup> At 6 c. c. per gram.

[Brain weighed daily. Received June 27, 1905. Original weight, 100.8 grams.]

| At the end of day.         | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. | At the end of day.           | Absolute weight. | Per cent of original weight. | Change in percentage of original weight from day to day. |
|----------------------------|------------------|------------------------------|--|------------------------------|------------------|------------------------------|--|
|                            | Grams.           |                              |  |                              | Grams.           |                              |  |
| First .....                | 90.5             | 89.78                        | - 10.22  | Twenty-seventh .....         | 88.0             | 87.30                        | + 0.49   |
| Second .....               | 87.5             | 86.81                        | - 2.97   | Twenty-eighth .....          | 88.0             | 87.30                        | + .00  |
| Third .....                | 86.5             | 85.81                        | - 1.00   | Twenty-ninth .....           | 88.5             | 87.79                        | + .49  |
| Fourth .....               | 86.5             | 85.81                        | + .00  | Thirtieth <sup>a</sup> ..... | 88.0             | 87.30                        | - .49  |
| Fifth .....                | 86.5             | 85.81                        | + .00  | Thirty-first .....           | 88.0             | 87.30                        | + .00  |
| Sixth .....                | 85.5             | 84.82                        | - .99  | Thirty-second .....          | 87.5             | 86.81                        | - .49  |
| Seventh <sup>a</sup> ..... | 86.0             | 85.31                        | + .49  | Thirty-third .....           | 87.5             | 86.81                        | + .00  |
| Eighth .....               | 86.5             | 85.81                        | + .50  | Thirty-fourth .....          | 87.5             | 86.81                        | + .00  |
| Ninth .....                | 86.5             | 85.81                        | + .00  | Thirty-fifth .....           | 87.0             | 86.31                        | - .50  |
| Tenth .....                | 87.0             | 86.31                        | + .50  | Thirty-sixth .....           | 87.0             | 86.31                        | + .00  |
| Eleventh .....             | 87.0             | 86.31                        | + .00  | Thirty-seventh .....         | 87.5             | 86.81                        | + .50  |
| Twelfth .....              | 87.0             | 86.31                        | + .00  | Thirty-eighth .....          | 87.5             | 86.81                        | + .00  |
| Thirteenth .....           | 87.0             | 86.31                        | + .00  | Thirty-ninth .....           | 87.5             | 86.81                        | + .00  |
| Fourteenth .....           | 86.5             | 85.81                        | + .50  | Fortieth .....               | 87.5             | 86.81                        | + .00  |
| Fifteenth .....            | 86.5             | 85.81                        | + .00  | Forty-first .....            | 87.5             | 86.81                        | + .00  |
| Sixteenth .....            | 87.0             | 86.31                        | - .50  | Forty-second .....           | 87.5             | 86.81                        | + .00  |
| Seventeenth .....          | 87.0             | 86.31                        | + .00  | Forty-third .....            | 87.5             | 86.81                        | + .00  |
| Eighteenth .....           | 87.0             | 86.31                        | + .00  | Forty-fourth .....           | 87.5             | 86.81                        | + .00  |
| Nineteenth .....           | 87.5             | 86.81                        | + .50  | Forty-fifth .....            | 87.0             | 86.31                        | - .50  |
| Twentieth .....            | 87.0             | 86.31                        | - .50  | Forty-sixth .....            | 87.5             | 86.81                        | + .50  |
| Twenty-first .....         | 87.5             | 86.81                        | + .50  | Forty-seventh .....          | 87.5             | 86.81                        | + .00  |
| Twenty-second .....        | 87.5             | 86.81                        | + .00  | Forty-eighth .....           | 87.5             | 86.81                        | + .00  |
| Twenty-third .....         | 87.3             | 86.61                        | - .20  | Forty-ninth .....            | 87.5             | 86.81                        | + .00  |
| Twenty-fourth .....        | 87.5             | 86.81                        | + .20  | Fiftieth .....               | 88.0             | 87.30                        | + .49  |
| Twenty-fifth .....         | 87.0             | 86.31                        | - .50  | Fifty-seventh .....          | 88.0             | 87.30                        | + .00  |
| Twenty-sixth .....         | 87.5             | 86.81                        | + .50  | Sixty-fourth .....           | 88.5             | 87.80                        | + .50  |

<sup>a</sup> Change of solution.

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# NOTES ON JAPANESE, INDOPACIFIC, AND AMERICAN PYRAMIDELLIDÆ.

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By WILLIAM HEALEY DALL,

*Curator, Division of Mollusks,*

AND

PAUL BARTSCH,

*Assistant Curator, Division of Mollusks.*

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While gathering material for the monograph of Pacific coast Pyramidellidæ on which the authors of the present paper have been for some time engaged, application for material for study was made to the Königliche Zoologische Museum in Berlin, where the types of many of the species treated of in the second edition of the Conchylien Cabinet were known to be preserved.

Through the kind intervention of the late Prof. Dr. Eduard von Martens, in charge of the conchological collection of the Berlin Museum, the entire series of their Pyramidellidæ, including numerous types, was lent to the U. S. National Museum for study. This series contained material from many sources, of which the most important were the collections of the late Henry and Arthur Adams, of Pætel, of Dunker, and Hilgendorf. Numerous specimens of species inadequately described by Arthur Adams from Japan were among the most valuable for our work, and the importance of accurately figuring and adequately describing them was evident, as, until such descriptions were made public, no small number of species of the Japanese fauna must remain doubtful.

Though mostly small and to many students uninteresting, the Pyramidellidæ exist in much larger numbers than is generally realized. To obtain a satisfactory view of their specific characters, in most cases the species must be studied under the microscope, and to get accurate figures of these minute creatures enlarged photographs or camera lucida drawings are essential. The difficulty of obtaining these in the present instance was much enhanced by the death of our chief draftsman and faithful collaborator, the late Dr. J. C. McConnell, for

whom so far it has been impossible to find an equally qualified successor in line drawing. The figures in the present paper are chiefly enlarged photographs, retouched with careful reference to the specimen. With the exception of the microscopically fine striation, which could in most cases only be indicated on a much larger figure than those given here, it is believed that the figures are exceptionally accurate and complete.

The compilation of a card catalogue of the described species of Pyramidellidæ has shown that the number is much greater than the compilers imagined before undertaking the work; and also that, apart from errors of identification, the specific names used for many of these species have often been repeatedly used, in some cases three or four times over, and of course it has become necessary to replace the pre-occupied name in each case by one not previously used in the genus. This will account for the number of new names for old species which occur in the present paper.

The senior author desires to say that his part in this paper has been of an advisory and editorial nature, and that the labor of comparisons, of preparing the diagnoses and comments, and practically the entire text, except the introduction, has been borne by the junior author, to whom the appreciation due on this account should be fully accorded.

The types, except where otherwise stated, have been returned to the Berlin Museum, where they may be consulted by students.

#### DESCRIPTIONS OF THE SPECIES.

##### **PYRAMIDELLA (LONGCHAEUS) BICOLOR Menke.**

*Pyramidella bicolor* MENKE, Malak. Blätt., I, 1854, p. 28.

Two specimens from the Pætel collection labeled *Obeliscus aelis* A. Adams, Japan, are absolutely identical with specimens of *P. bicolor* Menke, in our collection from Guacomayo, Mexico, and we firmly believe that the locality cited by Pætel is wrong.

##### **PYRAMIDELLA (PHARCIDELLA) HASTATA A. Adams.**

*Obeliscus hastatus* A. ADAMS, in Sowerby Thes., 1854, p. 811, No. 24.

Two shells labeled *Pyramidella pulchella* Dunker, new species (a manuscript name), are in the Dunker collection. There is no locality label with them. The shells are in every way identical with specimens in our collection of *P. hastatus* Adams, from Acapulco, Mexico.

**PYRAMIDELLA (PHARCIDELLA) MOFFATI, new name.**

*Obeliscus clavulus* A. ADAMS, in Sowerby Thes., 1854, p. 811, pl. CLXXI, fig. 33,  
not *Obeliscus clavulus* (Férussac) Beck, Index Moll., 1838, p. 62.

The Pætel collection contains a specimen of this species labeled *Obeliscus uchates* Gould, see *crocatus*, Japan. In the aperture of this shell a specimen of *Anachis diminuta* C. B. Adams was firmly wedged, which is at home on the west coast of Central America and Mexico. The *Pyramidella* therefore very likely belongs to the same region. The type of *O. clavulus* A. Adams came from Acapulco, Mexico.

**PYRAMIDELLA (TRIPTYCHUS) NIVEUS Mörch.**

*Triptychus nireus* MÖRCH, Mal. Blätt., XXII, 1875, p. 158.

Four specimens in the Pætel collection, labeled *Parthenia cæolata* A. Adams, Japan, belong to this species. It is quite likely that the locality cited is wrong, and that the specimens came from the West Indies, the home of *P. (T.) nireus*.

**PYRAMIDELLA (TIBERIA) PULCHELLA A. Adams.**

Plate XXV, fig. 4.

*Obeliscus pulchellus* A. ADAMS, in Sowerby Thes. Conch., 1854, p. 808, pl. CLXXI.

Shell very regular elongate-conic, yellowish-white, marked by two moderately broad, equal spiral zones of brown, one at the periphery, the other on the anterior portion of the base. Nuclear whorls two and one-half, moderately large, smooth, about one-third immersed in the first of the post-nuclear whorls, having their axis at right angles to the axis of these. Post-nuclear whorls polished, flattened, slightly shouldered at the summit, marked only by faint lines of growth; posterior half between the sutures pale yellow, anterior half white, bounded at the periphery by the spiral chestnut band which can be seen at the suture of all the whorls. Periphery of the last whorl slightly angular. Base short, rounded, marked by many lines of growth which are much stronger here than between the sutures; the basal color-band is separated from the columella by a narrow white zone. Aperture subovate, somewhat channeled at the junction of the outer lip and the columella, outer lip thin, apparently not fortified within by varices or spiral lamellæ; columella straight, rather strong, reflected, biplicate, the posterior fold large, lamellar, a little below the insertion of the columella, the anterior one much more oblique and but feebly developed, parietal wall covered by a very thin callus.

The Berlin collection contains four specimens, all from Japan; one, belonging to the Pætel collection is described and figured. It has lost

the earlier whorls, the eleven remaining measure: long. 12.2 mm.; diam. 4.6 mm. The other three come from H. Adams.

Another specimen, the nucleus of which is described, is No. 181207 U.S.N.M. This also comes from Japan. It has twelve post-nuclear whorls and measures: long. 11.3 mm.; diam. 4.3 mm.

**PYRAMIDELLA (TIBERIA) JAPONICA, new species.**

Plate XXIV, fig. 2.

Shell umbilicate, regularly elongate-conic, polished, bluish-white, with a diaphanous spiral band on the middle of the whorls between the sutures. Nuclear whorls two, moderately large, smooth, having their axis at a right angle to the axis of the later whorls, and about one-third immersed in the first of these. Post-nuclear whorls flattened, slightly shouldered at the summit, marked only by extremely fine lines of growth. Periphery of the last whorl angular; base rather short, well rounded, marked by rather coarse lines of growth. Aperture moderately large, suboval (outer lip fractured), showing indications of internal lirations; columella very strong, somewhat oblique, biplicate, the posterior fold lamellar, situated a little below the insertion of the columella; anterior fold weak and very oblique.

The type and only specimen is immature; it has eight post-nuclear whorls and measures: long. 6.1 mm.; diam. 2.8 mm.

The specimen is from the Pætel collection and comes from Japan; it was labeled *Syrnola vitrea* A. Adams.

**PYRAMIDELLA (TIBERIA) PUSILLA A. Adams.**

Plate XXIV, fig. 6.

*Obeliscus pusillus* A. ADAMS, in Sby. Thes. Conch., 1854, p. 809, pl. CLXXI, fig. 7.

Shell, small, minutely umbilicate, moderately stout, elongate-conic, milk-white. Nuclear whorls small, two and one-half obliquely immersed in the first of the succeeding whorls. Post-nuclear whorls slightly rounded, decidedly shouldered at the summits and somewhat angulate at the periphery, polished, marked only by lines of growth and extremely minute microscopical spiral striations. The slight peripheral angulations show above the summit of the succeeding whorl and help to render the sutures all the more conspicuous. Base of the last whorl rather long, well rounded. Aperture suboval, posterior angle acute, outer lip thin, columella slightly oblique and revolute, showing only a single fold at the edge. In specimens which have the outer lip fractured, the second, i. e., anterior fold comes plainly into view as well as five internal lirations of the outer lip.

The specimen described and figured is from Japan. It has eight post-nuclear whorls and measures: long. 6.4 mm.; diam. 2.6 mm. This is

a small, shining, milk-white species, which might easily be mistaken for a *Syrnola*, on account of the deep-seated anterior fold. Some of the specimens show faint irregular impressed axial lines, which we consider accidental. A. Adams described a species, *Obeliscus eburneus*,<sup>a</sup> which, according to the meager description, appears to differ from *P. (T.) pusilla* only in having the whorls here and there longitudinally sulcate. If these sulcations are the same as the irregular impressed axial lines seen in specimens of *P. (T.) pusilla*, then *P. (T.) eburnea* will have to be placed in the synonymy of *P. (T.) pusilla*. The Berlin material contains two shells, both from Japan, one of which was obtained from H. Adams, the other belongs to the Pætel collection.

**PYRAMIDELLA (TIBERIA) PUSILLA JACKSONENSIS, new subspecies.**

Plate XXVI, fig. 8.

There are two specimens of *Tiberia* in the Pætel collection from Port Jackson, Australia, which agree in general with *P. (T.) pusilla* A. Adams, but are uniformly stouter. We therefore separate them subspecifically under the above name. The type, figured, has eight postnuclear whorls and measures: long. 6.1 mm.; diam. 2.7 mm.

**PYRAMIDELLA (TIBERIA) TRIFASCIATA A. Adams.**

Plate XXV, fig. 6.

*Obeliscus trifasciatus* A. ADAMS, Proc. Zool. Soc., 1862, p. 232.

Shell elongate-conic, acuminate, minutely perforate, vitreous, with three rather broad spiral yellow bands, two of which appear between the sutures and the third on the middle of the base. Nuclear whorls two, small, well rounded, smooth, a little more than half obliquely immersed in the first of the succeeding whorls. Postnuclear whorls slightly rounded, moderately shouldered at the summits, polished, marked only by fine lines of growth and microscopic spiral striations, encircled between the sutures by two yellow bands, each of which is about one-quarter the width of the space between the sutures. The whorls are thus marked by a vitreous zone at the summit, then a yellow one, which is followed by another vitreous band, and finally the second yellow zone, which extends to the suture. Periphery of the last whorl well rounded; base rather long, marked with lines of growth and spiral striations as on the spire; the yellow band on the middle of the base is of the same width as the other two. Aperture rather small, suboval, posterior angle acute, outer lip thin, fortified deeply within by five subequal and subequally spaced interrupted spiral lamellæ; columella straight, strong, reflected, armed with two folds, a strong lamellar plait a little anterior to its insertion and a much weaker and

<sup>a</sup> Proc. Zool. Soc., 1862, pp. 232-233.

much more oblique posterior one; parietal wall apparently without callus.

The specimen described and figured is from the Pætel collection and comes from Japan. It was wrongly labeled *Agatha nitidula* A. Adams. The specimen has eight postnuclear whorls and measures: long. 6 mm.; diam. 2.7 mm.

**PYRAMIDELLA (TIBERIA) DUNKERI, new name.**

Plate XXV, fig. 2.

*Odontomia fasciata* DUNKER, Mal. Blätt., VI, 1860, p. 234; also Moll. Japonica, 1861, p. 17, pl. II, fig. 2; not (*Odontomia*) *Chrysallida fasciata* CARPENTER, Cat. Maz. Shells, 1856, p. 423.

Shell elongate-conic, acuminate, perforate, subdiaphanous, marked by two moderately broad golden yellow bands, one encircling the whorls a little posterior to the periphery; the other, which is about double the width of the first, is situated a little anterior to the middle of the base. In addition to these two bands a narrow white zone surrounds the whorls a little posterior to the middle between the sutures. Nuclear whorls two and one-half, small, half embedded in the first of the later whorls, having their axis at a right angle to the axis of these. Postnuclear whorls moderately rounded, decidedly shouldered at the summit, almost tabulated, marked by many faint lines of growth and closely placed microscopic spiral striations, which are equally well developed between the sutures and on the base. Periphery and base of the last whorl well rounded. Aperture small, suboval; posterior angle obtuse, outer lip thin, no internal lirations visible (these may prove to be present when a specimen is ground down); columella slender, reflected biplicate; posterior fold lamellar, situated a little anterior to the insertion of the columella, anterior fold very oblique, weak; parietal wall covered by a mere film of callus.

The type is from Ousima, Japan. It has eight postnuclear whorls and measures—long. 5 mm.; diam. 2.3 mm.

**PYRAMIDELLA (COSSMANNICA) ACICULATA A. Adams.**

Plate XXIV, figs. 1, 8.

*Obeliscus aciculatus* A. ADAMS, in Sowerby Thes. Conch., 1854, p. 809, pl. CLXXI, figs. 21, 36.

Shell elongate-conic, tapering to an extremely slender apex, polished, white, with a slight suffusion of brown at the apex and near the aperture. Nuclear whorls two, large compared with the early postnuclear whorls, helicoid, depressed, smooth, having their axis almost at a right angle to the axis of the later whorls and extending beyond the outline of these on the left side. The first three postnuclear whorls are well

rounded, the next five considerably flattened, the rest decidedly obese. The first five are vitreous, but as the shell grows older it gradually becomes milk-white; summits of the whorls closely appressed to the preceding whorl, the appressed portion appearing as a narrow band, which at first sight appears as the suture; this, however, is very inconspicuous. All the postnuclear whorls are marked by fine lines of growth and fine, closely-placed, wavy spiral striations. Periphery and base of the last whorl well rounded, marked by lines of growth and spiral striations as between the sutures. The area immediately adjoining the columella is decidedly depressed, forming a pit, but the axis is not perforate. Aperture auriform, moderately large, oblique; posterior angle acute, slightly channeled at the junction of the outer lip and columella; columella rather strong, very oblique, revolute showing only the lamellar posterior fold when the lip is complete. This fold is situated a little anterior to the insertion of the columella. Parietal wall covered by a decided callus. Specimens having the outer lip fractured show the well-developed, very oblique anterior fold, also seven spiral lirations all of which but the anterior one, which is stronger, are subequal and subequally spaced.

This species enjoys a wide distribution. The Pætel collection contains one specimen from Hawaii, which we figure and which was labeled *Pyramidella variegata* A. Adams, but is certainly not that species. The U. S. National Museum has six shells, No. 76720, from Wallis Island, one of which is here described, and three lots from the Viti Islands: No. 42219, seven specimens; No. 87933, five specimens, and No. 101414, three specimens, all of which are remarkably uniform in appearance. One specimen having the nucleus and fifteen postnuclear whorls measures—long, 17.3 mm.; diam. 4.4 mm.

**PYRAMIDELLA (ACTÆOPYRAMIS) EXIMIA** Lischke.

Plate XXIII, fig. 1.

*Monotypygmia erimium* LISCHKE, Mal. Blätt., XIX, 1872, p. 103; also Jap. Meer. Conch., Pt. 3, 1874, p. 59, pl. III, figs. 4-6.

Shell elongate-conic, solid, polished, early whorls white, later ones light chestnut-brown, encircled by subequal spiral zones. Nuclear whorls small, smooth, almost wholly immersed in the first post-nuclear whorl. First four post-nuclear whorls snowy white, the second half of the fifth one tinged with brown, remainder of the whorls brown. All of the whorls are moderately rounded, somewhat shouldered at the summit, sculptured by faint lines of growth and deeply incised, moderately broad spiral lines, of which there are six on the second, seven on the fourth, and on the remaining whorls between the sutures; on the penultimate the posterior incised line becomes obsolete and the flattened raised band therefore doubly as wide. These spiral

lines are crossed by very fine, equally spaced axial bars, which lend them a punctate appearance. The space between the incised lines is about four times as wide as the lines, and flattened. Periphery and base of the last whorl well rounded, sculptured like the space between the sutures; incised lines eleven. Aperture large, pyriform, posterior angle acute; outer lip sharp, wavy, showing the incised lines within; columella moderately strong, somewhat curved, and slightly revolute; fold not visible in the aperture; parietal wall covered by a faint callus.

The single specimen described above is in the Dunker collection. It has nine post-nuclear whorls which measure: long. 18.1 mm.; diam. 6.8 mm. This is very likely one of the specimens from the type collection which came from Japan.

**PYRAMIDELLA (ACTÆOPYRAMIS) FULVA A. Adams.**

Plate XXIII, fig. 4.

*Monoptygma fulva* A. ADAMS, Proc. Zool. Soc., 1851, p. 222.

Shell elongate-conic, greyish-black. Nuclear whorls decollated. Post-nuclear whorls well rounded, very high between the sutures, scarcely shouldered at the summit, marked by lines of growth, and moderately broad, deeply incised, minutely axially barred spiral lines, of which six occur upon the second to sixth whorl and seven upon the seventh to eighth, between the sutures. The spaces between these lines are flattened and minutely spirally striated. Periphery of the last whorl well rounded. Base somewhat prolonged, sculptured like the space between the sutures, having ten of the deeply incised spiral lines. Aperture large, narrow, suboval, posterior angle acute, columella short, moderately strong, twisted and slightly revolute, with a weak oblique fold near its insertion; parietal wall covered by a thin internal callus.

The specimen described belongs to the Paetel collection and comes from Japan. It has nine post-nuclear whorls which measure: long. 20.3 mm.; diam. 5.8 mm.

*P. (A.) fulva* differs from *P. (A.) eximia* by its more slender form, much higher whorls between the sutures, much less shouldered summits, much more prolonged base, narrower and more elongate aperture, the additional fine spiral striations on the raised portion between the deeply incised spiral lines, and by its color.

## PYRAMIDELLA (ACTÆOPYRAMIS) CASTA A. Adams.

Plate XIX, fig. 4.

*Monopygma casta* A. ADAMS, Proc. Zool. Soc., 1851, p. 223; also in Sowerby Thes., 1854, p. 818, pl. CLXXII, fig. 22.

Shell elongate-conic, moderately stout, yellowish-white. Nuclear whorls small, almost completely immersed in the first post-nuclear whorl; the periphery of the last volution only is visible, and this appears at right angles to the axis of the later whorls. Post-nuclear whorls moderately rounded, marked by mere lines of growth and many broad, deeply incised spiral channels, which are almost equal in breadth to the raised spaces bounded by them. These channels are crossed by numerous small axial riblets, which render the edges of the spiral raised bands somewhat crenulate. The spiral raised bands are faintly spirally striated. Ten of these incised channels appear between the sutures on the third and fourth, and eleven on the sixth and the penultimate whorl. The posterior channel is usually a little wider than the rest. Periphery and base of the last whorl well rounded, the latter sculptured like the spaces between the sutures, having twelve incised channels. Aperture suboval, posterior angle acute, outer lip wavy, rather strong and opaque; columella slender, curved and twisted with an oblique, obsolete fold near its insertion, parietal wall without marked callus.

There are two specimens among the Berlin material, both belonging to the Pætel collection and both from Japan. The largest, the one described above, has eight post-nuclear whorls and measures: long. 11.3 mm.; diam. 4.1 mm. The other has seven and one-half post-nuclear whorls and measures: long. 10.5 mm.; diam. 3.9 mm.

This species in general outline recalls *P. (A.) fulva*, but is much smaller, has many more incised spiral channels, and is white in color.

## PYRAMIDELLA (ACTÆOPYRAMIS) LAUTA A. Adams.

Plate XIX, fig. 5.

*Monopygma lauta* A. ADAMS, Proc. Zool. Soc., 1851, p. 222; also in Sowerby Thes., 1854, p. 817, pl. CLXXII, fig. 20.

Shell broadly elongate-conic, subturritid, rather stout, milk-white. Nuclear whorls small, almost completely immersed in the first post-nuclear whorl, only the tilted edge of two volutions is apparent, which indicates that the axis of nuclear whorls is at right angles to the axis of the later ones. Post-nuclear whorls inflated, strongly shouldered at the summit, decidedly rounded, marked by many weak, irregular axial riblets and very strong, broad, angular, incised, spiral channels, which are crossed by many more or less regularly spaced and subequally developed backward slanting axial riblets. These riblets

render the flattened and faintly spirally striated, raised spaces between the incised channels feebly crenulated on both edges. Five incised channels appear between the sutures on the second and third whorl and six on the fourth and fifth. Periphery and base of the last whorl well rounded, the latter sculptured like the space between the sutures, with six spiral channels. Aperture quite large, suboval, posterior angle obtuse, outer lip thin, denticulate. The incised spiral channels appear as a chain of squarish areolations within, by transmitted light; columella moderately strong, somewhat twisted and slightly reflected with a subobsolete oblique fold near its insertion; parietal wall covered by a very feeble callus.

The specimen described belongs to the Pætel collection. It is from Japan and has six and three-fourths post-nuclear whorls and measures: long. 7 mm.; diam. 3.3 mm.

**PYRAMIDELLA (ACTÆOPYRAMIS) AMCENA A. Adams.**

Plate XIX, fig. 1.

*Monoplygma amcena* A. ADAMS, Proc. Zool. Soc., 1851, p. 223.

Shell slender, elongate-conic, turritid, milk white. Nuclear whorls small, almost completely immersed in the first of the later whorls, the peripheral portion of the last volution only is visible, which shows that the axis of the nucleus is at right angles to the axis of the later whorls. Post-nuclear whorls very high between the sutures, decidedly shouldered, moderately well rounded, marked by rather coarse lines of growth and deeply incised spiral channels, which are crossed by many regular, quite well-developed, axial riblets. These little riblets divide the channels into regular chains of pits. There are five channels between the sutures on the second and third whorl and six on the following three. The raised portion between the channels is of about double the width of the channel, somewhat crenulated on both margins and faintly spirally striated. Periphery and base of last whorl well rounded, sculptured like the space between the sutures, with nine spiral channels, the raised spaces between them gradually diminishing in breadth toward the umbilical region, which is somewhat excavated. Aperture subquadrate, posterior angle acute, junction of columella and outer lip subchanneled; outer lip somewhat expanded at the outer edge, wavy in outline, rather thick, the incised channels appearing as mere lines within by transmitted light; columella straight, thin, fold not visible in the aperture; parietal wall without callus.

Two specimens are among the Berlin material, both in the Pætel collection and from Japan. The larger one, described above, has seven post-nuclear whorls, and measures: long. 7 mm.; diam. 2.6 mm. The smaller one, labeled *pupoides* A. Adams, has six post-nuclear whorls, and measures: long. 5.4 mm.; diam. 2.3 mm.

This species recalls *P. (A.) lauta*, but is much more slender.

## PYRAMIDELLA (ACTÆOPYRAMIS) PUNCTIGERA A. Adams.

Plate XIX, fig. 2.

*Monoplygma punctigera* A. ADAMS, Ann. Mag. Nat. Hist., VII, 1861, p. 296.

Shell slender, elongate-conic, milk white. Nuclear whorls two, moderately large, depressed helicoid, obliquely one-half immersed in the first of the later whorls. Post-nuclear whorls very high between the sutures, moderately rounded and shouldered at the summits, marked by rather coarse lines of growth and deeply impressed, equally spaced spiral channels, which are crossed by small, quite regular and regularly spaced riblets. The space between these riblets appears as a pit and the whole groove as a pitted channel. Six channels are present between the sutures on the second to fourth and seven on the last two whorls. Periphery and base well rounded, the latter sculptured like the space between the sutures, crossed by eight spiral channels. Aperture moderately large, subquadrate, posterior angle acute, (outer lip fractured), columella moderately strong, twisted, columellar fold not visible in the aperture, parietal wall covered by faint callus.

The specimen above described belongs to the Pætel collection. It has six post-nuclear whorls, and measures: long. 5.4 mm.; diam. 1.8 mm.

The present species in some respects resembles *P. (A.) amana* Adams, but is much smaller, much more attenuated, with proportionately much higher whorls.

## PYRAMIDELLA (ACTÆOPYRAMIS) DIGITALIS, new species.

Plate XIX, fig. 6.

The Pætel collection contains a young individual labeled "*Monoplygma digitalis* A. Adams," from Japan. We have been unable to find any reference to such a species, and are also unable to make it harmonize with any of the described forms. While we dislike to base a description upon a young individual, we nevertheless feel that the present report would be incomplete without it.

Nuclear whorls small, completely immersed, only the rounded periphery of the last is visible above the first of the succeeding volutions. Post-nuclear whorls three, inflated, well-rounded, shouldered, the second encircled by five and one-half strong, narrow, subequal, and subequally spaced spiral keels between the sutures, separated by spaces about one and one-half times as wide as the keels. These spaces are crossed at regular intervals by backward-slanting axial riblets which are about two-thirds as wide as the spiral keels but not quite as elevated. The axial ribs and spiral keels inclose quite regular, depressed, rhombic areas. There are six spiral keels on the third whorl. Periphery and base well rounded, the latter somewhat produced and excavated near the small umbilical chink, ornamented like the spaces between

the sutures, having eight spiral keels. Aperture oval, somewhat effuse at the junction of the columella and outer lip, posterior angle obtuse; outer lip strong, rather thick, showing as many low, rounded lirations within as there are spaces between the keels on the outside; columella strong, armed with a well-developed oblique fold a little anterior to its insertion; parietal wall covered by a thin callus.

The specimen measures: long. 2.2 mm.; diam. 1.3 mm.

**PYRAMIDELLA (SYRNOLA) CINNAMOMEA A. Adams.**

Plate XXVI, fig. 1.

*Elusa cinnamomea* A. ADAMS, Proc. Zool. Soc., 1862, p. 237.

Shell slender, elongate-conic, of almost rectilinear outline, polished, yellowish-brown. Nuclear whorls two and one-half, rather large, helicoid, moderately elevated, smooth, having their axis at a right angle to the axis of the later whorls and about one-fourth immersed in the first of them; the periphery of the nucleus extends slightly beyond the outline of the spire on the left side. Post-nuclear whorls quite high between the sutures, flattened, separated by slight sutures marked only by faint lines of growth and numerous extremely fine and closely placed spiral striations. Periphery and base of the last whorl well rounded, the latter rather short. Aperture small, suboval, posterior angle narrow and acute, outer lip thin, columella short, curved, moderately strong, with an inconspicuous oblique fold near its insertion; parietal wall covered by a thin callus.

The specimen described and figured belongs to the Pætel collection and comes from Japan. It has eight post-nuclear whorls, and measures: long. 4.2 mm.; diam. 1.1 mm.

This shell has the aspect of a small, straight *Eulima*.

**PYRAMIDELLA (SYRNOLA) BRUNNEA A. Adams.**

Plate XXIV, figs. 4, 7.

*Obeliscus brunneus* A. ADAMS, in Sowerby Thes., 1854, p. 810, pl. CLXXI, fig. 35.

*Obeliscus buxeus* GOULD, Proc. Bost. Soc. Nat. Hist., VII, 1861, p. 403.

Shell elongate-conic, light brown, shining. Nuclear whorls two and one-half, small, depressed helicoid, polished, having their axis at a right angle to the axis of the latter whorls and about one-sixth immersed in the first of them. Post-nuclear whorls flattened, slightly shouldered, rather low between the sutures, marked only by lines of growth and microscopic spiral striæ. Sutures subchanneled and minutely crenulated. Periphery and base of last whorl well rounded, marked like the spaces between the sutures. Aperture suboval, posterior angle acute; outer lip thin; columella short, somewhat twisted and revolute, bearing a strong oblique fold a little anterior to its insertion; parietal wall covered by a thin callus.

A. Adams's type came from Japan. The above description is based upon two individuals from a lot of four, U. S. National Museum collection, No. 170808, which come from Hirado, Hizen, Japan. The nucleus was described from one specimen and the post-nuclear characters from the most perfect individual in the collection, which belongs to the same lot; this has sixteen post-nuclear whorls, and measures: long. 17, 6 mm.; diam. 4.5 mm. This specimen is a little more slender than the average individual. One, having fourteen post-nuclear whorls, measures: long. 14.2 mm.; diam. 4.3 mm. Some show five well-developed, subequal and subequally spaced interrupted lirations on the outer lip. The fine spiral striations are quite superficial and do not appear on specimens which are somewhat worn. There are two other specimens, No. 130076, in the U. S. National Museum from Japan. Gould's type of *Obeliscus bureus* is from the China Seas; it is an immature shell of ten post-nuclear whorls and is registered as No. 339. A specimen received from Eastlake, No. 160634, was collected at Hongkong, China. The Berlin collection contains one worn and bleached individual which is lacking a number of the early post-nuclear whorls. It was labeled *Obeliscus bicolor* Menke, California, which of course is an error. *O. bicolor* is a triplicate species = *Pyramidella (Longchæus) bicolor* Menke.

**PYRAMIDELLA (IPHIANA) LISCHKEI, new species.**

Plate XXV, fig. 1.

Shell slender, elongate-conic, subdiaphanous, polished, girdled by two golden-yellow bands between the sutures. Nuclear whorls decolated. Post-nuclear whorls rather high between the sutures, very slightly shouldered and well rounded, marked by rather strong lines of growth and scarcely visible closely placed spiral striations. The posterior band lies somewhat posterior to the middle of the whorl, while the anterior one is somewhat posterior to the periphery, showing therefore, on all the whorls a little above the well-marked suture. Periphery of the last whorl well rounded. Base attenuated. Aperture suboval, posterior angle acute, outer lip slightly expanded anteriorly, without internal lirations, columella reenforced by the attenuated base, and almost enveloped by it, bearing a moderately strong, oblique fold near its insertion; parietal wall covered by a thin callus.

The specimen described above belongs to the Pætel collection and comes from Japan. It has eight post-nuclear whorls, and measures: long. 4.6 mm.; diam. 1.4 mm.

## PYRAMIDELLA (IPHIANA) TENUISCUPTA Lischke.

Plate XXVI, figs. 3, 5.

*Obeliscus tenuisculptus* LISCHKE, Mal. Blätt., 1872, XIX, p. 102; also Jap. Meer. Conch., III, 1874, pp. 58-59, pl. III, figs. 7-8.

Shell, elongate-conic, sides of the spire rectilinear in outline, pale wax-yellow. Nuclear whorls decollated. Post-nuclear whorls flattened, increasing very regularly in size, slightly shouldered at the summit, separated by well-marked sutures, and marked by faint lines of growth and numerous fine, closely spaced spiral striations. Periphery of the last whorl somewhat angulated. Base very short, well rounded and slightly excavated at the umbilical region, sculptured like the space between sutures. Aperture subquadrate, posterior angle acute, outer lip thin, without internal lirations, columella short, somewhat twisted, revolute, bearing a moderately strong oblique fold a little anterior to its insertion.

The specimen described belongs to the Pætel collection, and is from Japan. It has eleven post-nuclear whorls (the apex and perhaps the first two or three post-nuclear whorls being lost), and measures: long. 10.4 mm.; diam. 2.9 mm. It was labeled *Obeliscus balteatus* A. Adams.

## PYRAMIDELLA (STYLOPTYGMA) SEROTINA A. Adams.

Plate XVII, fig. 5.

*Syrnola serotina*, A. ADAMS, Proc. Zool. Soc., 1862, p. 234.

Shell very small, elongate-conic, wax-yellow, darker toward the apex. Nuclear whorls one and one-half, rather large, loosely coiled, white, obliquely immersed in the first post-nuclear whorl, i. e., the first post-nuclear whorl encircles the nucleus and is thereby rendered quite large and stands out beyond the general outline of the shell. Post-nuclear whorls polished, moderately rounded, marked by faint lines of growth and here and there by an impressed axial line. Spiral sculpture absent. The first four whorls are marked by a rather broad, conspicuous reddish-brown band which encircles them at about one-third of the distance between the sutures anterior to the summit; on the fifth and sixth whorls this band appears as a faint line. The periphery of the last whorl is also encircled by a pale reddish-yellow spiral zone, part of which can be seen projecting above the well-impressed sutures on the preceding two volutions. Periphery and base of the last whorl well rounded, the latter rather short, marked like the space between the sutures. Aperture subquadrate, posterior angle acute (outer lip fractured), showing several internal lirations; columella stout with a strong oblique fold somewhat anterior to its insertion; parietal wall covered by a thin callus.

The specimen here described belongs to the Pætel collection. It has seven post-nuclear whorls, and measures: long 3 mm.; diam. 1.1 mm.

## PYRAMIDELLA (AGATHA) VIRGO A. Adams.

Plate XVIII, fig. 2.

*Agatha virgo* A. ADAMS, Ann. Mag. Nat. Hist., VI, 1860, p. 422,*Myonia virgo* A. ADAMS, Ann. Mag. Nat. Hist., VII, 1861, p. 295,*Menestho virgo* A. ADAMS, Ann. Mag. Nat. Hist., VII, 1861, p. 295,*Myonia virgo* A. ADAMS, Ann. Mag. Nat. Hist., VIII, 1861, p. 142,*Amathis virgo* A. ADAMS, Ann. Mag. Nat. Hist., VIII, 1861, p. 304.

Shell elongate-conic, subturrit, milk-white. Nuclear whorls two, small, well rounded, obliquely about one-half immersed in the first post-nuclear whorl. Post-nuclear whorls rather high between the sutures, inflated, well rounded, shouldered, marked by irregular lines of growth which lend the surface a somewhat uneven appearance and many fine, closely-placed wavy spiral striations; sutures strongly marked. Periphery of the last whorl with a faint suggestion of an angulation. Base prolonged, gently rounded, marked like the spaces between the sutures. Aperture elongate-ovate, posterior angle obtuse, somewhat effuse at the junction of the lip and columella; outer lip thin without internal lirations; columella short, curved, with a very strong, acute, oblique fold near its insertion which fuses directly and is continuous with the anterior reflected portion of the columella; parietal wall covered by a very thin callus.

The specimen described was received from Hilgendorf and comes from Japan. It has ten post-nuclear whorls and measures: long. 13.7 mm.; diam. 4.4 mm. There are two other individuals among the Berlin material, both young specimens and both from Japan. *P. (A.) virgo* A. Adams is the type of *Agatha*; we do not know why Adams changed this to *Myonia* and *Amathis* as we have been unable to find the name preoccupied.

## TURBONILLA (CHEMNITZIA) MULTIGYRATA Dunker.

Plate XX, fig. 4.

*Turbonilla multigyrate* DUNKER, Ind. Moll. Mar. Jap., 1882, II, pl. XIII, figs. 18-20.

Shell large, elongate-conic, milk-white. Nuclear whorls three, large, helicoid, moderately elevated, having their axis at a right angle to the axis of the later whorls and scarcely at all immersed in the first of them. Post-nuclear whorls well rounded, the greatest convexity falling a little anterior to the middle between sutures, moderately shouldered, and ornamented by strong, rounded, oblique, flexuose axial ribs, which are somewhat fused at the summit and more so at the periphery. Intercoastal spaces rounded, not quite as wide as the ribs, decidedly depressed, terminating suddenly at the periphery. Fourteen axial ribs are present upon the first, eighteen upon the fifth, twenty upon the tenth, and twenty-four upon the penultimate whorl. Suture channeled, periphery somewhat angulate, the summits of succeeding whorls

fall a little anterior to the peripheral termination of the depressed intercostal spaces and leave a very narrow smooth band apparent in the suture. Base of the last whorl very short, slightly rounded, with a small depressed area at the columella. Aperture subquadrate, moderately large, posterior angle obtuse, outer lip thin, showing the external sculpture within by transmitted light; columella short, straight, and slightly revolute, with a weak, deep seated, oblique fold near its insertion, which is not apparent in the aperture when this is viewed squarely.

The type comes from Japan, has fifteen post-nuclear whorls and measures: long. 11.5 mm.; diam. 2.8 mm.

**TURBONILLA (CHEMNITZIA) DUNKERI Clessin.**

Plate XX, fig. 3.

*Turbonilla dunkeri* CLESSIN, Mart. Chem. Conch. Cab., 2d ed., Pyram., 1900, p. 257, pl. XLI, fig. 3.

Shell elongate-conic, gently tapering, dirty white. Nuclear whorls three, small, decidedly elevated, very loosely coiled, having their axis at a right angle to the axis of the later whorls and scarcely at all immersed in the first of them. Post-nuclear whorls very slightly rounded, almost flattened in the middle between the sutures, rather high, marked by strong, rounded, oblique axial ribs which extend prominently from the summit of the whorls to the periphery. Intercostal spaces about as wide as the ribs, decidedly depressed, extending from the summit to the periphery, where they suddenly terminate. Twelve axial ribs are present on the first, sixteen on the fifth, and twenty-one on the penultimate whorl. These ribs are not at all fused at the summit of the whorls, but remain distinct. At the periphery, however, they do become fused and terminate the depressed interspaces. Sutures subchanneled. Periphery of the last whorl slightly angulated. Base moderately long and gently rounded. Aperture small, subquadrate, posterior angle obtuse, outer lip thin, columella slender, slightly curved and somewhat revolute, having a weak, very oblique, deep-seated fold near its insertion, which is not visible in the aperture when this is viewed squarely.

There are three specimens in the Dunker collection, Clessin's types; they are from Nagasaki, Japan. The largest one of these, the one above described, has eleven post-nuclear whorls and measures: long. 6.2 mm.; diam. 1.6 mm. The smallest one agreeing in every way with the larger specimen, has nine post-nuclear whorls and measures: long. 4.2 mm.; diam. 1.2 mm.

Clessin's figure of this species is so poor that it not only fails in delineating the characters of the species, but is absolutely misleading.

**TURBONILLA (CHEMNITZIA) ABSEIDA, new species.**

Plate XXI, fig. 4.

Shell large, elongate-conic, milk-white, shining. Nuclear whorls decollated. Post-nuclear whorls decidedly rounded, slightly shouldered and somewhat constricted at the periphery, marked by very strong lamellar oblique axial ribs and deeply impressed intercostal spaces which are about twice as wide as the ribs. The ribs do not fuse at the summit but terminate strongly as cusps, rendering the outline of the summits wavy; they fuse at the periphery and there suddenly terminate the deep intercostal spaces. The type, which has lost the nucleus and perhaps the first three post-nuclear whorls, has fourteen ribs on the first (remaining), sixteen on the fifth, and twenty-two on the penultimate whorl. The summits of succeeding whorls on the later volutions drop a little anterior to the periphery and permit a narrow plain band to appear above the suture. Periphery of the last whorl slightly angulated. Base short, well rounded. Aperture moderately large, subquadrate, posterior angle obtuse; outer lip thin, showing the external sculpture within by transmitted light; columella oblique, revolute, with a weak oblique fold at its insertion.

The type and five additional specimens belong to the Dunker collection and come from Japan. One of these has been donated to the U. S. National Museum, where it is entered as No. 185886. The ten remaining post-nuclear whorls in the type measure: long. 8.4 mm.; diam. 2.3 mm. Another specimen lacking only the nucleus has twelve post-nuclear whorls and measures: long. 8 mm.; diam. 2.3 mm. It is possible that this form may be *Turbonilla perfecta* A. Adams, but this can only be decided when Adams' types shall have been located. His scant descriptions and lack of measurements make positive identification impossible when dealing with *Chemnitzia*, *Turbonilla*, or *Odostomia*.

**TURBONILLA (CHEMNITZIA) APPROXIMATA, new species.**

Plate XX, fig. 1.

Shell elongate-conic, gently tapering, white. Nuclear whorls decollated. Post-nuclear whorls flattened, slightly shouldered, ornamented by strong, rather narrow, oblique, axial ribs which are distinct at the summit but fuse at the periphery. Twelve of these ribs appear on the first, fifteen upon the fifth, eighteen upon the tenth, and twenty-two upon the penultimate whorl. Intercostal spaces a little wider than the ribs, decidedly depressed, terminating suddenly at the periphery. The summit of the succeeding whorls falls a little anterior to the termination of the intercostal spaces and leaves a very narrow smooth area above the well-marked sutures. Periphery of the last whorl very

slightly angulated, base moderately long and well rounded. Aperture moderately large, subquadrate, posterior angle acute, outer lip thin, showing the external sculpture within by transmitted light; columella slender, oblique, somewhat revolute; columellar fold not apparent in the aperture, parietal wall covered by a thin film of callus.

There are two specimens in the Berlin collection, both belong to the Dunker collection and come from Japan; one of these has been donated to the U. S. National Museum and is entered as No. 185887, the other, the type, has thirteen post-nuclear whorls, and measures: long. 8.2 mm.; diam. 2.1 mm.

**TUBONILLA (CHEMNITZIA) INFANTULA, new species.**

Plate XX, fig. 2.

Shell very small, slender, milk-white. Nucleus prominent, helicoid, with elevated spire, consisting of two and one-half whorls, which are about one-fourth immersed in the first of the later whorls and have their axis at a right angle to the axis of these. Post-nuclear whorls six, moderately rounded and ornamented by strong, oblique ribs, of which sixteen occur upon the first and eighteen upon the penultimate whorl. Intercostal spaces about as wide as the ribs, terminating abruptly at the periphery. Base smooth. Aperture moderately large; outer lip (fractured). This is a young specimen; we add it to make the report complete. It was collected by Hilgendorf in Japan and measures: long. 2.1 mm.; diam. .6 mm.

**TURBONILLA (CHEMNITZIA) ACTOPORA, new species.**

Plate XX, fig. 6.

Shell very slender, elongate-conic, white. Nuclear whorls small, helicoid, obliquely one-third immersed in the first of the later whorls. Post-nuclear whorls rather high between the sutures, flattened and somewhat shouldered at the summit, marked by rather poorly developed, low, broad, rounded, obliquely slanting axial ribs of which fourteen appear upon the second, sixteen upon the fifth and tenth whorl. On the penultimate these ribs are subobsolete. Intercostal spaces shallow, narrow, terminating at the periphery. Periphery and base of the last whorl well rounded, smooth. Aperture moderately large, subquadrate; posterior angle obtuse, outer lip thin, showing the external sculpture within by transmitted light; columella oblique, straight, somewhat revolute, bearing a low, rounded fold a little anterior to its insertion; parietal wall covered by a mere film of callus.

The Dunker collection contained five specimens of this species, one of which has been donated to the U. S. National Museum, No. 185888, all from Japan. The type has twelve post-nuclear whorls and measures: long. 6.8 mm.; diam. 1.5 mm.

The slender shape and poorly developed sculpture which becomes subobsolete on the last whorl will differentiate this from the other described species.

**TURBONILLA (CHEMNITZIA) ACOSMIA, new species.**

Plate XX, fig. 5.

Shell rather stout, broadly elongate-conic, gently tapering, milk-white. Nuclear whorls one and three-fourths, planorboid, large, extending somewhat beyond the outline of the spire on the left side, scarcely at all immersed, having their axis at a right angle to the axis of the later whorls. Post-nuclear whorls rather high between the sutures, slightly rounded, somewhat shouldered, ornamented by rather low, broad, rounded, oblique axial ribs (which are badly worn on the first two whorls), the third contains fourteen, the fifth twenty, and the penultimate thirty; these ribs are distinct at the summit, but fuse at the periphery of the whorls. Intercostal spaces narrow, scarcely depressed below the general surface of the shell, extending to the periphery. Sutures well marked. The summits of the last three whorls fall a very little anterior to the termination of the intercostal spaces and leave a very narrow plain band above the suture. Periphery and base of the last whorl well rounded. Aperture subquadrate, somewhat produced and effuse at the junction of the columella and the outer lip; posterior angle acute, outer lip thin, showing the external sculpture within by transmitted light; columella straight, oblique, somewhat revolute, with a very weak, low, oblique fold a little anterior to its insertion.

The type belongs to the Dunker collection and is without definite locality. All the other Pyramidellids in the Dunker collection are from Japan. It is quite probable therefore that this may also be the home of the present species. The type and only specimen has ten post-nuclear whorls and measures: long. 8.4 mm.; diam. 2.4 mm.

*T. acosmia* is similar in outline and ribbing to *Turbonilla* (*Strioturbonilla*) *secura* = (new name for *Turbonilla obeliscus* Gould,<sup>a</sup> not *Chemnitzia obeliscus* C. B. Adams,<sup>b</sup> = *Turbonilla* (*Strioturbonilla*) *obeliscus* C. B. Adams) from Simons Bay, Cape Town, South Africa, but lacks the fine spiral striæ and is in every way somewhat smaller.

**TURBONILLA (CHEMNITZIA) GARRETTIANA, new name.**

Plate XXI, fig. 5.

*Odostomia sulcata* GARRETT, Proc. Acad. Nat. Sci. Philadelphia, 1873, p. 224, pl. III, fig. 46. Not *Turbonilla sulcata* DE FOLIN, 1871.

Shell moderately large, subdiaphanous, bluish white, shining. Early whorls decollated. Later whorls almost flattened, somewhat shouldered

<sup>a</sup>Proc. Bost. Soc. Nat. Hist., VII, 1861, p. 406. <sup>b</sup>Contr. to Conch., 1850, pp. 72-73.

at the summits, ornamented with poorly developed, broad, low, almost vertical axial ribs which are strongest at the summit of the whorls and gradually grow weaker toward the periphery. The first three post-nuclear whorls probably are lost. The second of those left has eighteen ribs; the antipenultimate twenty-four and the penultimate twenty-two; on this they are much weaker than on the preceding whorls. Inter-costal spaces broad and shallow, scarcely sunk below the general surface of the shell, becoming obsolete toward the periphery like the ribs. Sutures well marked. Base of the last whorl rather prolonged, smooth. Aperture moderately large, suboval, posterior angle acute; outer lip thin, junction of the columella and outer lip well rounded; columella oblique, somewhat revolute, provided with a prominent fold, a little anterior to its insertion; parietal wall covered by a thin callus. The sixteen remaining whorls measure: long. 7.3 mm.; diam. 2.1 mm.

The type is No. 58111 of the collection of the Philadelphia Academy of Natural Sciences and was collected by Garrett, in the Viti Islands.

**TURBONILLA (CHEMNITZIA) CRENULATA Menke.**

Plate XXI, fig. 6.

*Oxytrema crenulata* MENKE, Synopsis Methodica Molluscorum, 1830, p. 137.

Shell elongate-conic, subturritid, milk-white. Nuclear whorls decollated. Post-nuclear whorls flattened, somewhat shouldered at the summit, crossed by strong, rounded, very oblique, slightly sinuous, axial ribs, of which sixteen occur upon the fourth, twenty upon the tenth, and twenty-four upon the penultimate whorl. These ribs show a tendency toward fusing at the summit of the whorl, where they become slightly thickened; they extend strongly to the well-impressed sutures. Intercostal spaces about one-half as wide as the ribs, moderately depressed, terminating suddenly at the somewhat angulated periphery of the last whorl. Base of the last whorl short, well rounded, moderately large, marked only by lines of growth. Aperture subquadrate, somewhat effuse at the junction of the lip and columella, posterior angle acute, outer lip thin, showing the external sculpture within by transmitted light, columella straight, almost vertical, somewhat revolute, provided with a very weak oblique fold at its insertion; parietal wall covered by a thin callus.

There are two specimens in the Pætel collection which we believe to be the types. They are labeled "Mexico." They agree in every respect, except in the number of whorls. We have figured and described the larger one of the two, which has thirteen post-nuclear whorls and measures: long. 8.6 mm; diam. 2 mm.

Menke<sup>a</sup> states that the specimens were collected by Doctor Schiede. Upon search it was ascertained that Doctor Schiede collected on the

<sup>a</sup>Synopsis Methodica Molluscorum, 1830, p. 137.

Atlantic side, especially about Vera Cruz. It is, therefore, quite likely that this may be the home of the present species.

*Oxytrema* was proposed by Rafinesque for a genus of *Melanians*.

### NISITURRIS, new subgenus.

Plate XXIV, fig. 3.

This subgenus is proposed for *Turbonilla* (N.) *crystallina*, which is differentiated from all the *Turbonillas* which we have seen by its very peculiar nucleus. The nucleus in *Turbonilla* is helicoid or planorboid; in this individual, however, it is pupoid—that is, the nuclear whorls resemble a small sinistral pupa placed obliquely on the later whorls. The post-nuclear characters are those of *Chemnitzia* s. s.

### TURBONILLA (NISITURRIS) CRYSTALLINA, new species.

Plate XVII, fig. 7. Plate XXIV, fig. 3.

*Chemnitzia crystallina* DUNKER, Cat. Mus. Godeffroy, IV, 1869, p. 78 (a nomen nudum), not *Pyramis crystallina* BROWN, 1827 (= *Odostomia*) nor *Odostomia crystallina* GARRETT, 1873 (= *Pyramidella* (*Iphiana*) *crystallina*), nor *Odostomia* (*Auriculina*) *crystallina* Monterosato, see Carus. Prod. Fauna Medit., p. 275, 1893; = *O. diaphana* Jeffreys.

Shell very slender and thin, elongate-conic, slightly umbilicated, almost transparent. Nuclear whorls large, very much elevated, coiled to resemble a small sinistral Pupa, smooth, situated obliquely upon the spire of the post-nuclear whorls and extending considerably beyond the lateral outline of this. Post-nuclear whorls rather high between the sutures, somewhat overhanging (this is particularly true of the earlier volutions), slightly shouldered at the summit, ornamented by strong, oblique, rounded axial ribs, which are slightly cusped at their posterior extremity, where they show a tendency toward becoming fused; fused at the periphery; twenty-two of these ribs occur upon the first (this whorl is more rounded than the rest and closer ribbed), fourteen upon the second, twelve upon the fifth, sixteen upon the tenth, and twenty upon the penultimate whorl. The intercostal spaces are twice as wide as the ribs, decidedly depressed, smooth, terminating at the fusing point of the ribs on the periphery. The summits of succeeding whorls fall somewhat anterior to the periphery of the preceding whorl and give the whorls an overhanging effect as well as a narrow smooth band between the anterior termination of the intercostal spaces and the subchanneled sutures. Periphery and base of the last whorl well rounded, the latter very short, marked only by faint lines of growth. Aperture very large, almost circular in outline, outer lip thin, transparent, showing the external sculpture within; columella thin, curved and revolute, with a slight oblique fold near its insertion; parietal wall covered by a mere film of callus.

The type belongs to the Dunker collection and comes from Upolu, one of the Samoan Islands. It has twelve post-nuclear whorls and measures: long. 4.5 mm.; diam. 1 mm. The nuclear whorls measure about 1 mm. long. This species is the type of the subgenus *Visiturris*, which differs from *Chemnitzia* s. s. by having the peculiar nucleus of the present species.

**TURBONILLA (STRIOTURBONILLA) MONOCYCLA A. Adams.**

Plate XXII, fig. 8.

*Turbonilla monocycla* A. ADAMS, Ann. Mag. Nat. Hist., VI, 1860, p. 418; not *Parthenia* (= *Odostomia* (*Egila*?) *monocycla* A. ADAMS.

Shell elongate-conic, slender, slightly umbilicated, milk-white. Nuclear whorls small, almost completely obliquely immersed in the first post-nuclear whorl. Post-nuclear whorls very finely, wavily, spirally striated, shouldered at the summit, flattened, with a well impressed sulcus at the periphery; marked by strong, decidedly sinuous axial ribs, of which sixteen occur upon the second, nineteen upon the fifth, and thirty upon the penultimate whorl. These ribs pass over the moderately deep peripheral sulcus and render the intersections with its edges subnodulose. The entire sulcus to the anterior edge is visible above the suture; this therefore appears very deep. Intercostal spaces not quite as wide as the ribs. Base well rounded, sculptured by the continuation of the axial ribs, which extend to the umbilicus, and the minute spiral striation. Aperture rather large, suboval, posterior angle obtuse; outer lip thin, showing the external sculpture within by transmitted light; columella slender, curved, and revolute, provided with a quite strong oblique fold at its insertion.

The specimen described belongs to the Pætel collection, and comes from Japan. It has eight post-nuclear whorls, and measures: long. 4.3 mm.; diam. 1.5 mm. Another lot from the same collection and locality contains two additional specimens, both immature.

**TURBONILLA (PYRGISCULUS) CANDIDISSIMA, new name.**

Plate XVII, fig. 3.

= *Dunkeria candida* A. ADAMS, Ann. Mag. Nat. Hist., VIII, 1861, p. 301; not *Chemnitzia candida* A. ADAMS, Proc. Zool. Soc., 1853; nor *Turbonilla candida* DE FOLIN, Fonds de la Mer, I, 1871.

Shell, milk-white, elongate-conic, with strongly, slopingly shouldered whorls. Nuclear whorls small, obliquely almost completely immersed. Post-nuclear whorls inflated, summits strongly, slopingly shouldered, ornamented by strong, decidedly elevated subacute, axial ribs, of which about twelve occur upon the first, eighteen upon the fifth, and twenty-two upon the penultimate whorl. These ribs extend prominently over the shoulder to the summit. Intercostal spaces about double the width of the axial ribs, crossed by alternate raised

and depressed spiral bands between the sutures, the raised bands are usually a little wider than the depressions, are spirally striated, and show here and there a tendency to bifurcation. Nine depressed areas are present upon the second, eleven upon the fifth, and the penult whorl, the posterior two of which are situated upon the shoulder and are less strongly developed than the rest. Periphery and base of the last whorl well rounded, the latter somewhat produced, and sculptured like the spaces between the sutures, by the axial ribs, which extend quite prominently to the umbilicus and ten spiral raised and depressed bands. Aperture large, oval, outer lip thin, showing five deep-seated, interrupted, spiral lirations, the posterior ones of which are stronger and more distantly spaced; columella slender, revolute, curved, provided with a quite prominent fold near the insertion; parietal wall covered by a quite strong callus.

The specimen described belongs to the Dunker collection and comes from Nagasaki, Japan. It has eight post-nuclear whorls, and measures: long. 6.7 mm.; diam. 2.2 mm. There are two other specimens with this, one of which served for the description of the nucleus, which is lost in the type. Two other lots, both from Nagasaki, Japan, contain two and three specimens, respectively.

In some individuals the ribs are somewhat thickened at the anterior end of the shoulder and give this part a crenulated appearance; the width of the raised, spiral areas is also narrower in some individuals than the depressed areas.

#### TURBONILLA (PYRGISCUS) MUMIA A. Adams.

Plate XVII, fig. 1.

*Chrysallida mumia* A. ADAMS, Ann. Mag. Nat. Hist., VII, 1861, p. 45; not *Chemnitzia mumia* STOPANI, 1858, which is not a Pyramidellid.

Shell elongate-conic, small, white. Nuclear whorls three, moderately large, helicoid, having their axis at a right angle to the axis of the later whorls and about one-third immersed in the first of them. Post-nuclear whorls slightly rounded, almost flattened, shouldered at the summit with strong rounded axial ribs which render the summits of the whorls subcrenulate. There are fourteen of these ribs on the first, twenty on the fifth, and twenty-two on the penultimate whorl. Inter-costal spaces about as wide as the ribs, crossed by a slender equal and equally spaced raised spiral threads, of which there are eight on the fourth and ten on the penultimate whorl between the sutures. Periphery of the last whorl somewhat angulated. Base attenuated, sculptured like the spaces between the sutures, by the axial ribs and ten spiral threads. Aperture rather small, outer lip (fractured) showing the external markings within, columella somewhat oblique, straight, revolute, with a fold near its insertion which would scarcely be visible in a specimen with a perfect aperture.

The specimen described and figured belongs to the Pætel collection, and comes from Japan. It has eight post-nuclear whorls, and measures: long. 3.3 mm.; diam. 1. mm.

**TURBONILLA (CINGULINA) CINGULATA Dunker.**

Plate XXI, fig. 1.

*Turbonilla cingulata* DUNKER, Mal. Blätt., VI, 1860, p. 239; also Moll. Jap., p. 16, 1861, pl. VIII, fig. 13; not *Monoptygma* or *Oscilla cingulata* A. ADAMS.

Shell elongate-conic, slender, milk-white. Nuclear whorls three, large, helicoid, rather elevated, smooth, having their axis at a right angle to the axis of the later whorls, and about one-fourth immersed in the first of them. Post-nuclear whorls ornamented between the sutures by three strong, moderately rounded, raised spiral keels, which are separated by channels of about the same width; the first keel is at the summit of the whorl; these raised keels are marked axially by irregular lines of growth while the depressed channels are crossed by numerous more or less equally developed and equally spaced slender axial bands. A trace of the first keel anterior to the periphery may be seen above the suture in several of the last whorls. The periphery of the last whorl is marked by the anterior edge of the third channel, the next keel anterior to this is like those between the sutures, the remainder of the short base is marked by five less strongly developed keels and channels, the space about the umbilical region having faint, wavy spiral striations. Aperture moderately large, suboval, posterior angle obtuse, slightly effuse at the junction of the outer lip and columella; outer lip arcuate, columella short, slender, curved, with a small and very oblique fold near its insertion which scarcely shows in the aperture; parietal wall covered by a thin callus.

The above description was made from Dunker's type specimen, the nucleus was described from a specimen belonging to the type lot which comes from Nagasaki, Japan. The type has twelve post-nuclear whorls (is minus the nucleus), and measures: long. 7.4 mm.; diam. 2.1 mm.

The type lot contains four specimens. Another lot from Hilgendorf comes from Enosima, Japan, and one belonging to the Pætel collection is labeled simply Japan.

Dunker states that the last whorl has eight lirations. He appears to have overlooked the basal one, which is not sharply defined in the somewhat worn type.

**TURBONILLA (CINGULINA) CINGULATA LATICINGULA, new sub-species.**

Plate XXI, fig. 3.

Shell similar to *T. (C.) cingulata*, a little more slender, with the nuclear whorls about one-third buried; the small axial bars are a little more pronounced and only four basal keels are present, the first one

anterior to the periphery being extremely wide, fully double the width of the next. The aperture also is a little more effuse at the junction of the outer lip and the columella.

The type has nine post-nuclear whorls, and measures: long. 4 mm.; diam. 1.2 mm. It belongs to the Pætel collection, and comes from Japan.

**TURBONILLA (MORMULA) PHILIPPIANA** Dunker.

Plate XVIII, fig. 5.

*Turbonilla philippiana* DUNKER, Mal. Blätt., VI, 1860, p. 239; also Moll. Jap., 1861, p. 16, pl. 1, fig. 12.

Shell broadly conic, vitreous to milk-white. Nucleus decollated. Post-nuclear whorls well rounded, moderately shouldered, crossed by about twenty strong, rounded axial ribs; intercostal spaces rounded, a little wider than the ribs, crossed by nine subequal and subequally spaced, moderately broad incised spiral lines which extend up on the sides of the axial ribs. At irregular intervals several axial ribs are fused and enlarged to form a varix. Periphery and base of last whorl well rounded, the latter marked by the faint continuations of the axial ribs, which scarcely extend to its middle, and twelve well incised, wavy, spiral lines which become wider and more distantly spaced toward the umbilical region. Aperture rather small, subquadrate; posterior angle obtuse; columella short, somewhat straight, twisted; columellar fold not visible in the aperture; parietal wall covered by a thin callus.

Two specimens are before us; Dunker's type, from Desima, Japan, a poor and much-worn individual and another in the U. S. National Museum, received from A. Adams, collected in Japan and labeled *Mormula rissouina* A. Adams. These two specimens appear both to be young shells and are absolutely identical. We have therefore described and figured the more perfect of the two, which we do not believe to be *M. rissouina* A. Adams. Both have seven and one-half post-nuclear whorls which in the U. S. National Museum specimen No. 126062 measure: long. 5.3 mm.; diam. 2.6 mm. Dunker's specimen (type) measures: long. 5.5 mm.; diam. 2.6 mm.

**TURBONILLA (MORMULA) AULICA**, new name.

Plate XXII, fig. 7.

*Turbonilla varicosa* DUNKER, Mal. Blätt., VI, 1860, p. 339; also Moll. Jap., 1861, p. 15, pl. 11, fig. 9; =? *Chemnitzia varicosa* A. ADAMS, 1853, not *Parthenia* (*Mormula*) *varicosa* FORBES, Report Aeg. Inv., 1844, p. 136, nor *Turbonilla varicosa* DODERLEIN, 1892.

Shell elongate-conic, gently and evenly tapering; flesh-color with a brown base. Nuclear whorls decollated. Post-nuclear whorls well rounded, somewhat shouldered, crossed by strong rounded axial ribs,

about sixteen of which appear on the fourth, eighteen on the eighth, and twenty-two on the penultimate whorl. At irregular intervals several of these ribs are fused and enlarged to form a varix, five of which are present on this shell. Intercoastal spaces about as wide as the ribs, marked by seven moderately broad, incised, spiral lines between the sutures; the posterior one of these is at some little distance below the summit. These lines are subequally spaced and of about the same width, except the last one, which is about twice as broad as the others and marks the periphery with a series of rectangular pits. The elevated spaces between the incised lines pass over the axial ribs and render them faintly nodulose. The spaces inclosed between the first and second, fourth and fifth, and sixth and seventh spiral lines are a little more elevated than the rest and hence appear as stronger nodes on the ribs. Periphery of the last whorl angulated. Base short, moderately rounded, marked by the feeble continuation of the axial ribs, which hardly extend to the umbilical region, and eight well-incised subequally spaced, wavy, spiral lines, the raised area between the anterior one of these and the series of pits at the suture is like the raised spaces between the incised lines between the sutures; the rest appear as mere wavy raised threads. Aperture subquadrate, posterior angle obtuse, outer lip showing the external sculpture within; columella straight, twisted, without apparent fold, parietal wall covered by a thin callus. Columella brown; this color tinges the adjacent area, fading out altogether on the middle of the base.

Dunker's type, the specimen here described and figured, comes from Desima, Japan. It has fourteen postnuclear whorls and measures: long. 9.6 mm.; diam. 2.2 mm.

**TURBONILLA (LANCELLA) BELLA, new species.**

Plate XXII, fig. 6.

Shell elongate-conic, slender, vitreous to milk-white. Nuclear whorls three, large, helicoid, considerably elevated, smooth, having their axis almost at a right angle to the axis of the later whorls. Post-nuclear whorls quite high between the sutures, well rounded, with a mere indication of a shoulder at the summit, ornamented by moderately strong, rounded axial ribs, about eighteen of which occur upon the second, twenty on the fifth, and twenty-eight upon the penultimate whorl. Intercoastal spaces about two-thirds the width of the ribs. The spiral sculpture between the sutures consists of equal and subequally spaced alternate raised and depressed areas, both of which pass over the axial ribs and lend them a subnodulose aspect; eight of these areas appear on the third, nine upon the fifth, and eleven upon the penultimate whorl. In addition to the above-described sculpture, seven irregularly distributed varices are present, which consist of several enlarged and fused axial ribs. The first one of these appears on the

first post-nuclear whorl. Periphery of the last whorl angular. Base very short, almost flat, marked by faint continuations of the axial ribs and twelve wavy, spiral lirations which are separated by channels of about the same width; both lirations and channels are widest at the periphery and gradually become smaller toward the umbilical area. Aperture rather small, subquadrate, posterior angle obtuse, outer lip thin, showing the external sculpture within; columella straight, slender, and somewhat revolute; columellar fold not apparent in the aperture; parietal wall covered by a mere film of callus.

The type has nine and one-eighth post-nuclear whorls and measures: long. 7.5 mm.; diam. 2.3 mm. It belongs to the Pætel collection and comes from Japan. It was labeled *Mormula elongata* H. Adams, which was evidently intended for *Turbonilla* (*Lancea*) *elongata* Pease, as A. Adams has not described a *T. elongata*. The present species strongly recalls *T. (Lancea) peasei*, but differs from it in nuclear structure, in the number of alternating raised and depressed spiral area and in the structure of the base which in *peasei* is sculptured like the space between the sutures.

**TURBONILLA (LANCELLA) PEASEI, new name.**

=*Turbonilla* (*Lancea*) *elongata* PEASE, Am. Jour. Conch., III, 1868, p. 293, pl. xxiv, fig. 22. Not *Turbonilla elongata* KÖNINCK, 1841; nor *Chemnitzia elongata* PHILIPPI, 1844; nor *Chemnitzia humboldtiana elongata* REQUIEN 1848. *Turbonilla* (*Lancea*) *peasei* is the type of the subgenus *Lancea*.

**BABELLA, new subgenus.**

Shell with strong axial ribs between the sutures and three spiral keels, two of which are at the periphery, which falls in the deep sulcus between them, and one a little anterior to the middle of the base.

Type.—*Turbonilla* (*Babella*) *cælatior*, new name.

**TURBONILLA (BABELLA) CÆLATIOR, new name.**

Plate XVII, fig. 9.

*Parthenia cæolata* A. ADAMS, Jour. Linn. Soc. London, VII, 1863, p. 4; not *Turbonilla cæolata* GOULD, Proc. Bost. Soc. Nat. Hist., VII, 1861, p. 406; nor *Chemnitzia cæolata* CARPENTER, Ann. Mag. Nat. Hist., XV, 1865, p. 400, which may be called *hypocurta*.

Shell elongate-conic, turritid, milk-white. Nuclear whorls small, three, helicoid, rather loosely coiled and elevated, having their axis at a right angle to the axis of the later whorls and about one-third immersed in the first of them. Post-nuclear whorls flattened, strongly sculptured, with axial ribs and three spiral keels. There is a strong, rounded, rather broad spiral keel on each side of the deeply sulcate periphery; the peripheral sulcus is about as wide as a keel and marks the path for the shouldered and crenulated summit of the succeeding whorls. A second deep spiral sulcus, equal in width to the peripheral

one, is situated just posterior to the posterior keel, and this marks the anterior termination of the strong, rounded, backward-slanting axial ribs between the sutures. Sixteen of these ribs occur upon the second, seventeen upon the fifth, and twenty upon the penultimate whorl. Intercostal spaces almost as wide as the ribs, crossed by two strongly impressed, moderately broad spiral lines, which also pass over and somewhat constrict the axial ribs, giving them a dumbbell-shaped outline; the posterior thickened portion is a little wider than the anterior one. The space between these two deeply impressed lines is crossed by about eight minute, subequally spaced spiral striations. Periphery of the last whorl deeply sulcate, crossed by numerous closely spaced axial striations, keel anterior to the periphery almost as strong as the one posterior to it; the third keel is a little anterior to the middle of the base and is rather low and broad; the space between it and the keel above is gently rounded and finely axially striated, which is also true of the space between this keel and the umbilical area. Aperture moderately large, suboval, effuse at the junction of the outer lip and columella; posterior angle obtuse, outer lip thin, irregular in outline, showing the external sculpture within; columella short, curved, stout, bearing a strong, acute, oblique fold a little anterior to its insertion; parietal wall covered by a thin callus.

There are two lots of this species in the Berlin collection, both from Japan; one, No. 1446, containing two specimens, was received from H. Adams, and it is one of these that we have here described and figured. This specimen has nine post-nuclear whorls and measures: long. 4.4 mm.; diam. 1.5 mm. The other belongs to the Pætel collection.

**ODOSTOMIA (TRABECULA) TANTILLA A. Adams.**

Plate XXII, fig. 3.

*Pyrgulina tantilla* A. ADAMS, Jour. Linn. Soc. London, VII, 1863, p. 5.

Shell small, slender, turritid, milk-white. Nuclear whorls small, strongly obliquely immersed in the first post-nuclear whorl, only a portion of the last volution is visible. Post-nuclear whorls strongly shouldered, moderately rounded, rather high between the sutures, and appearing somewhat constricted at this point, marked by strong, rounded, backward slanting axial ribs, which render the summits of the whorls strongly crenulate; fourteen of these ribs occur upon the second, twenty-three upon the fourth, and thirty-two upon the penultimate whorl. Intercostal spaces about twice as wide as the ribs, crossed between the sutures by five subequally spaced, raised spiral threads, the posterior one of which is a little farther from the summit than it is from its adjacent fellow; it is also a little less strongly developed than the rest. The ribs and spiral threads thus form a series of meshes or reticulations. Periphery and base of the last

whorl well rounded, sculptured, like the spaces between the sutures, by the axial ribs which continue prominently to the narrow umbilicus, and six subequal and subequally spaced spiral threads, with an indication of a very weak seventh within the narrow umbilicus. Aperture moderately large, ovoid, posterior angle obtuse, outer lip strong, columella slender, decidedly curved, and somewhat revolute, with a prominent oblique fold near its insertion; parietal wall covered by a very strong callus, which gives the peristome a complete appearance.

The U. S. National Museum has two specimens from A. Adams, collected in Japan, No. 126005, the larger one of which has furnished the figure and the above description, excepting the aperture, which is imperfect in this specimen and was described from the second individual. The large one has seven post-nuclear whorls and measures: long. 2.6 mm.; diam. 0.9 mm. The Pætel collection contains one from Japan.

**ODOSTOMIA (PARTHENINA) META, new species.**

Plate XXIII, fig. 5.

Shell milk-white, very small, thin, turritid, with channeled sutures and obtuse apex. Nuclear whorls small, strongly obliquely immersed in the first post-nuclear whorl; only a portion of the last volution is visible. Post-nuclear whorls somewhat overhanging, rather high between the sutures, shouldered at the summit, flattened, suddenly contracted below the periphery. The summits of succeeding whorls fall considerably anterior to the periphery, which appears decidedly angular. The whorls are marked by strong axial ribs which extend undiminished over the angular periphery and base of the last whorl to the umbilical region. Sixteen of these ribs occur upon the second, twenty-two upon the fourth and the penultimate whorl. The ribs are slightly constricted just below the summit, which gives them a beaded appearance. Intercostal spaces about twice as wide as the ribs, crossed by two closely placed, raised spiral threads, the anterior one of which marks the angulation of the periphery. The junction of ribs and spiral threads is subnodulose. Base moderately long, narrowly umbilicate. Aperture suboval, posterior angle obtuse, outer lip rather thick, columella strongly curved, with a prominent oblique fold near its insertion; parietal wall covered with a heavy callus, which gives the peristome a completed aspect.

The specimen described belongs to the Pætel collection and comes from Japan. It has six post-nuclear whorls and measures: long. 2.1 mm.; diam. 0.8 mm.

## ODOSTOMIA (CHRYSTALLIDA) DUX, new species.

Plate XVII, fig. 4.

Shell ovate-conic, white. Nuclear whorls moderately large, obliquely deeply immersed in the first post-nuclear whorl, the peripheral portion only of the last volution projects above the edge. Post-nuclear whorls moderately rounded, strongly crenulately shouldered, marked between the sutures by four spiral keels, the posterior two of which are a little more closely spaced than the rest and twenty axial ribs which do not extend entirely across the whorl but terminate at the sulcus which separates the third from the fourth keel. Each junction of an axial rib and a spiral keel is marked by a tubercle; the tubercles of the first and second keel belonging to the same axial rib are somewhat fused, there being a less prominent constriction between them than between the second and third, the complete effect being that of an exclamation point. The fourth spiral keel is strong and rounded and decidedly elevated, a very slender extension of the axial rib reaches across the deep spiral sulcus, which like the sulci of the base is crossed by fine, subequally spaced, raised axial threads. Base moderately well rounded, attenuated, ornamented with five subequal and subequally spaced, somewhat flattened, spiral keels. Aperture rather large, sub-oval, effuse at the junction of the outer lip and the columella; posterior angle acute, outer lip wavy, thin, showing the external sculpture within; columella strong, curved, reenforced by the attenuated base, provided with a strong fold at its insertion; parietal wall covered by a thin callus.

The type has four post-nuclear whorls, and measures: long. 1.8 mm.; diam. 1 mm. It is from Japan and belongs to the Pætel collection.

Of the twenty-eight species described as *Chrysallida* by A. Adams, we have been able to refer only one positively to this group, namely *C. plicata*.

## ODOSTOMIA (PYRGULINA) DENSECOSTATA Garrett.

Plate XVIII, fig. 4.

Shell elongate-ovate, very thin, subdiaphanous, milk-white, shining. Nuclear whorls almost completely obliquely immersed in the first post-nuclear whorl. Post-nuclear whorls rounded, rather inflated, moderately shouldered, and marked by many well-developed, regular, rounded, toward the aperture slanting axial ribs, of which twenty occur upon the second, twenty-four upon the fifth, and thirty upon the penultimate whorl. These ribs are somewhat thickened at their posterior extremity and give the summits of the whorls a beaded appearance. Intercoastal spaces a little wider than the ribs, crossed by many incised spiral lines, which are about as wide as the raised spaces between them. These incised spiral lines are a little less strongly developed on the

posterior portion of the whorls, where the ribs are thickened, but anterior to these thickenings they are very regular and regularly spaced. There are eighteen on the fifth and twenty-six on the penultimate whorl. Periphery and base of the last whorl well rounded, the latter marked by the strong continuations of the axial ribs, which extend almost undiminished to the umbilical region. The intercostal spaces on the base are marked like those between the sutures by twenty-two incised spiral lines. Sutures well marked. Aperture moderately large, posterior angle acute, outer lip thin, showing the external sculpture within; junction of columella and outer lip well rounded; columella decidedly curved, thin, somewhat revolute, provided with a prominent oblique fold, a little anterior to its insertion. This fold joins the columella in such a manner as to give this a decidedly sigmoid curve. Parietal wall without callus.

Garrett's types embrace six specimens, all from the Viti Islands. The best developed one is here described and figured. It has eight post-nuclear whorls, and measures: long. 4 mm.; diam. 1.7 mm. The specimens belong to the Academy of Natural Sciences, Philadelphia, where they are entered as No. 58110. P. Fischer<sup>a</sup> considered this species synonymous with *Odostomia* (= *Pyrgulina*) *interstriata* Sowerbie. In this we do not agree with him, but consider the present species distinct.

**ODOSTOMIA (PYRGULINA) DENSECOSTATA UPOLUENSIS, new subspecies.**

Plate XVIII, fig. 1.

Shell elongate-conic, subturritid, early whorls bluish-white, later ones milk-white. Nuclear whorls small, almost completely obliquely immersed in the first post-nuclear whorl; only half of the tilted last volution can be seen. Post-nuclear whorls slightly rounded, the posterior two-thirds between the sutures almost flattened, somewhat shouldered, marked by strong obliquely backward-slanting rounded axial ribs which are somewhat thickened and subcuspidate at the summits; fourteen of these ribs occur upon the first, eighteen upon the third, twenty-four upon the fifth and on the penultimate whorl. Intercostal spaces somewhat variable in width, one to one and one-half times as wide as the ribs, crossed by fine subequal and subequally spaced impressed spiral lines, the spaces between them being a little wider than the impressed lines; about twenty of these lines occur between the sutures on the fifth and twenty-two upon the penultimate whorl. Periphery and base of the last whorl well rounded, the latter marked like the spaces between the sutures by the strong continuation of the axial ribs, which extend undiminished to the small umbilical

<sup>a</sup>Jour. de Conch., XXIV, 1876, p. 150.

chink, and by twenty impressed spiral lines which here are almost as wide as the spaces between them. Aperture suboval, outer lip thin, showing the external sculpture within; columella slender, curved, and reflected, with a moderately strong, oblique fold at its insertion; parietal wall covered by a moderately thick callus which gives the peristome an almost continuous appearance.

The type and another specimen belong to the Pætel collection and come from Upolu, one of the Samoan Islands. The type has seven post-nuclear whorls and measures: long. 3.7 mm.; diam. 1.5 mm. It differs from *O. (P.) densecostata* Garrett in being more slender, having the whorls less inflated and rounded (*densecostata* has them decidedly rounded) and in having a greater number of axial ribs.

ODOSTOMIA (PYRGULINA) ALVEATA A. Adams.

Plate XXII, fig. 5.

*Chrysallida alveata* A. ADAMS, Ann. Mag. Nat. Hist., VII, 1861, p. 45.

Shell small, oblong, ovate, milk-white. Nuclear whorls decollated. Post-nuclear whorls rather high between the sutures, moderately rounded, strongly shouldered at the summit, which is subtabulated, crossed by strong, rounded, almost vertical axial ribs, which render the summit of the whorls crenulate. Eighteen of these ribs occur upon the third, and nineteen upon the penultimate whorl. Intercostal spaces about one-half as wide as the ribs, crossed by about twelve fine, subequally spaced, incised spiral lines. The summits of succeeding whorls fall a little anterior to the somewhat angulated periphery of the preceding whorl on the earlier volutions, and gives them a somewhat constricted appearance at the deep sutures. Periphery of the last whorl very faintly angulated. Base well rounded, somewhat pinched at the umbilical region, marked by the strong continuations of the axial ribs, and about ten spirally incised lines in the spaces between them. Aperture oval, posterior angle obtuse, outer lip thick (fractured) showing seven equally well-developed and equally spaced internal lirations; columella short, decidedly curved and revolute, with a strong oblique fold at its insertion; parietal wall covered by a thin callus.

The specimen described and figured belongs to the Pætel collection and comes from Japan. It has five post-nuclear whorls, and measures: long. 2. mm.; diam. 1.1 mm. It is badly worn, which prevents making an accurate count of the incised spiral lines; there are, however, probably twenty between the suture and the summit on the penultimate whorl and perhaps a similar number on the base. Adams in his description does not mention the internal lirations of the outer lip, but these are usually deep-seated, or appear at intervals, and may not have been apparent in the specimen originally described.

## ODOSTOMIA (PYRGULINA) LECTA, new species.

Plate XXII, fig. 2.

Shell elongate-ovate, turrited, shouldered, sutures crenulated, shining, hyaline to milk-white. Nuclear whorls moderately large, deeply obliquely immersed in the first of the succeeding whorls, only the last half turn of the last volution is visible from the side. Post-nuclear whorls rather high between the sutures, somewhat flattened, the summit of the succeeding whorls falls a little anterior to the periphery of the preceding one, which gives the whorls a constricted appearance at the suture. The whorls are ornamented by strong sublamellar axial ribs, which are thickened and cuspid at the summit; fourteen of these ribs occur upon the first, sixteen upon the third, and twenty upon the penultimate whorl. Intercoastal spaces broad and rounded, fully three times the width of the ribs, crossed by narrow, incised spiral lines, which are about one-fourth as wide as the space inclosed between them; twelve of these lines occur between the sutures upon the fourth and penultimate whorls. Periphery and base of the last whorl well rounded, the latter attenuated, marked like the space between the sutures by the prominent continuations of the axial ribs and ten incised strong, spiral lines. Aperture suboval (outer lip fractured), columella short, curved, reenforced by the attenuated base, provided with a strong, oblique fold near its insertion; parietal wall covered by a moderately thick callus, which extends over the umbilical area.

The specimen described has six post-nuclear whorls and measures: long. 3.4 mm.; diam. 1.5 mm. It belongs to the Pætel collection and was labeled *Chrysallida plicata* A. Adams, Japan. It is not *C. plicata* A. Adams, but may be one of the following species, of which Adams's description is not sufficiently diagnostic to make identification possible without authentic material: *Chrysallida pupula*, *consobrina*, and *casta*, all of which appear to belong to the subgenus *Pyrgulina*.

## ODOSTOMIA (PYRGULINA) AMANDA Garrett.

Plate XVIII, fig. 3.

*Odostomia amanda* GARRETT, Proc. Acad. Nat. Soc. Phila., 3d ser., III, 1873, p. 225. pl. III, fig. 47.

Shell, slender; elongate, conic, milk-white. Nuclear whorls, three; moderately large, helicoid, having their axis at a right angle to the axis of the later whorls and scarcely immersed in the first of them. Post-nuclear whorls moderately rounded, somewhat shouldered, ornamented by strong rounded vertical or slightly backward-slanting axial ribs which are thickened at the summit to form small cusps. Sixteen of

these ribs occur upon the first, twenty upon the third, twenty-two upon the fifth, and twenty-six upon the penultimate whorl. Intercostal spaces, about as wide as the ribs, crossed by well-incised, equal and subequally spaced spiral lines which are about one-fourth as wide as the spaces inclosed between them. There are no spiral lines in the intercostal spaces near the summit of the whorls; the first one falls about parallel with the anterior limit of the cuspid summit of the axial ribs; nine lines occur between the sutures on the fourth, eleven on the fifth, and twelve on the penultimate whorl. Periphery of the last whorl very slightly angulated. Base well rounded, marked by strong continuations of the axial ribs, which extend to the umbilical region, and eighteen incised spiral lines in the intercostal spaces; these lines gradually become more crowded toward the umbilical region. Aperture moderately large, suboval, somewhat effuse at the junction of the outer lip and columella; posterior angle acute, outer lip thin, showing the external sculpture within; columella oblique, slightly curved, and somewhat revolute, reenforced by the somewhat attenuated basal portion of the last whorl; provided with a weak oblique fold at its insertion; parietal wall without perceptible callus.

The specimen described and figured is Garrett's type. It belongs to the Philadelphia Academy of Natural Sciences, where it is entered as No. 58109. It comes from the Viti Islands, has seven post-nuclear whorls and measures: long. 3 mm.; diam. 1.1 mm. The Pætel collection contains a specimen which was collected at Upolu, one of the Samoan Islands.

#### EGILINA, new subgenus.

*Odostomias* having strong axial ribs between the sutures which are interrupted at the periphery by a deep spiral sulcus. Intercostal spaces smooth. Base ornamented by spiral keels, the spaces between which are marked by many very slender axial threads.

*Type*.—*Odostomia (Egilina) mariella* A. Adams.

#### ODOSTOMIA (EGILINA) MARIELLA A. Adams.

Plate XXII, fig. 4.

*Parthenia mariella* A. ADAMS, Ann. Mag. Nat. Hist., VI. 1860, p. 415.

Shell small, umbilicated, regularly conic with obliquely truncated apex and deeply channeled sutures; milk-white. Nuclear whorls almost completely immersed in the first post-nuclear whorl; only half of the last volution projects above it. Post-nuclear whorls flattened, marked by strong, very obliquely backward-slanting axial ribs, which are thickened at the summits and constricted a little below the summit, which renders the top of each rib beaded. Anteriorly the ribs are terminated by the posterior margin of the peripheral sulcus; here the ribs expand somewhat and almost fuse, and this expansion gives

them a subnodulose effect at this point. Intercostal spaces smooth, about as wide as the axial ribs, decidedly depressed in the middle—that is, between the bead at the summit and the nodules at the periphery. Periphery of the last whorl deeply sulcate. Base well rounded, marked by about nine spiral lirations, the posterior one of which is decidedly wider than the rest; the depressed spaces between the lirations are marked by fine axial threads. Both the spiral lirations and the spaces between them gradually diminish in width from the periphery to the umbilical area. Aperture suboval, posterior angle acute, columella strongly oblique, somewhat revolute, reenforced by the somewhat attenuated base and provided with a fairly strong oblique fold near its insertion; parietal wall covered by a thick callus, which gives the peristome a continuous appearance. On the last whorl the first basal keel appears above the sutures, which is therefore notchanneled like the sutures of the preceding whorls.

The specimen described has four post-nuclear whorls and measures: long. 1.8 mm.; diam. .8 mm. It belongs to the Pætel collection and comes from Japan. It was labeled *Parthenia pagodula* A. Adams, but is not that species.

**ODOSTOMIA (MIRALDA?) JAMAICENSIS Clessin.**

Plate XVII, fig. 6.

*Miralda jamaicensis* CLESSIN, Martini-Chemnitz, Conchylien Cabinet, 2d ed., Pyramid., 1900, p. 262, pl. xxxiv, fig. 6.

Shell elongate-ovate, turrited, milk-white. Nuclear whorls two, small, helicoid, obliquely half immersed in the first of the succeeding volutions. Post-nuclear whorls moderately rounded, strongly tabulately shouldered at the summit, ornamented by broad, slightly rounded spiral keels, three of which occur between the sutures on the first and second, and four upon the penultimate whorl. The posterior one of these keels is situated at the summit of the whorl and is not as wide as the others, and appears as if it might be strongly crenulated in well-preserved specimens. The second keel also shows traces of crenulations. The incised channels between the keels are about one-fourth as wide as the keels and are crossed by very fine, raised, quite closely spaced, backward-slanting axial threads. Periphery and base of the last whorl well rounded. The latter marked by a strong raised spiral keel on its middle and a lesser tumid area at the umbilical region; the space between the middle keel and the periphery appears to be without spiral sculpture. The entire base is crossed by lines of growth. Sutures very strongly channeled. Aperture large, broadly oval, somewhat produced at the junction of the columella and lip; posterior angle obtuse, outer lip rather thick; columella strong, curved, reenforced by the attenuated base and provided with a moderately strong oblique fold near its insertion.

There are two specimens in the Berlin collection, No. 28742, from Jamaica, obtained by Verkrutzen; they have the aspect of Bowden bed fossils. The best preserved individual has four post-nuclear whorls and measures: long. 2.1 mm.; diam. 1.2 mm. If the specimens prove to be not crenulated, but simply spirally keeled, then it will have to be transferred to the subgenus *Odetta*. Clessin's figure of this species<sup>a</sup> is wretchedly poor.

**ODOSTOMIA (MIRALDA) DIADEMA A. Adams.**

Plate XVII, fig. 2.

*Parthenia diadema* A. ADAMS, Ann. Mag. Nat. Hist., V, 1860, p. 479.

Shell small, subovate, minutely umbilicated, with the summits of the whorls decidedly tabulated, white. Nuclear whorls two, moderately large, helicoid, about one-third immersed in the later whorls. Post-nuclear whorls moderately rounded, decidedly tabulated at the summit, ornamented by rounded, axial ribs which quickly diminish in strength as they pass from the summit of the whorls to the periphery; sixteen of these ribs occur upon the second, and twenty upon the penultimate whorl. The ribs are thickened at the anterior termination of the shoulder and render it decidedly crenulated. Intercoastal spaces a little wider than the ribs. In addition to the axial ribs the whorls are marked by strong spiral cords, two of which can be seen between the sutures on the first and second and four and one-half upon the penultimate whorl; the junction of the posterior one of these two cords and the axial ribs form a series of tubercles. The anterior cord is only slightly tuberculated, the ribs extending only feebly to it. Periphery and base of the last whorl well rounded, the latter decidedly attenuated and marked by seven subequal and subequally spaced spiral keels. Aperture large, suboval, posterior angle very obtuse, outer lip thick, columella reenforced by the attenuated base, curved, provided with a conspicuous oblique fold near its insertion; parietal wall covered by a moderately thick callus.

There are two specimens of this species in the Berlin collection, collected in Japan and obtained from H. Adams. The better preserved one of the two has been described. It has five post-nuclear whorls and measures: long. 2.3 mm.; diam. 1.2 mm.

**ODOSTOMIA (MIRALDA) GEMMA A. Adams.**

Plate XXII, fig. 1.

*Chrysallida gemma* A. ADAMS, Ann. Mag. Nat. Hist., VIII, 1861, p. 302.

Shell small, elongate-conic, slender, slightly umbilicated, white. Nuclear whorls at least two, obliquely about half immersed in the first of the later whorls. Post-nuclear whorls flattened, with strong

<sup>a</sup> Martini-Chemnitz, Conchylien Cabinet, 1900, p. 262, pl. xxxiv, fig. 6.

tabulated and crenulated summits, crossed by three strong, rounded, subequally spaced, spiral keels and rounded axial ribs between the sutures; the latter extend from the summit to and over the second keel, but not over the sulcus separating this from the third. The junctions of the axial ribs and spiral keels form strong tubercles. Sulcus between the second and third keel deep, decidedly deeper than the peripheral sulcus, both of which, as well as the sulci of the base are crossed by minute closely placed, axial raised threads. Base of the last whorl well rounded, somewhat attenuated, marked by five strong, rounded, subequal and subequally spaced spiral keels. Aperture oval, posterior angle acute, outer lip wavy, columella short, curved and slightly revolute, provided with a quite strong oblique fold near its insertion; parietal wall covered by a moderately thick callus.

The specimen described and figured belongs to the Pætel collection and comes from Japan. It has six post-nuclear whorls and measures: long. 3.2 mm.; diam. .8 mm. The U. S. National Museum has a specimen, No. 185889, from H. Adams, also from Japan.

**ODOSTOMIA (MIRALDA) species?**

The Pætel collection contains another specimen of *Miralda* which is in every way heavier than *O. (M.) diadema* A. Adams. It is, however, so badly worn that positive identification at the present time is impossible. It has five post-nuclear whorls and measures: long. 2.2 mm.; diam. 1.4 mm. It is labeled *Miralda diadema* A. Adams, and comes from Japan, but is not that species.

**ODOSTOMIA (MENESTHO) EXARATISSIMA, new name.**

Plate XIX, figs. 3, 7.

= *Menestho exarata* A. ADAMS, Ann. Mag. Nat. Hist., VIII, 1861, p. 303, not *Parthenia exarata*, CARPENTER, 1856.

Shell elongate-conic, soiled white. Nuclear whorls at least two, moderately large, helicoid, one-half obliquely immersed in the first post-nuclear volution, the periphery projecting slightly beyond the left outline of the spire. Post-nuclear whorls well rounded, very slightly shouldered, marked by faint lines of growth and well incised spiral lines, which are not all of the same strength nor are they equally spaced. Six of these appear upon the second, and seven upon the penultimate whorl between the sutures. Periphery and base of the last whorl well rounded, the latter sculptured like the space between the sutures, bearing six incised lines which are not quite as strong as those between the sutures. Aperture oval, effuse at the junction of the outer lip and the columella, posterior angle obtuse, outer lip thin, but opaque, columella short, curved, somewhat revolute, reenforced by the attenuated base, parietal wall covered by a faint callus.

There are five specimens of this species in the Berlin collection. They were obtained by Hilgendorf at Hakodate, Japan. The one above described has six post-nuclear whorls and measures: long. 4.2 mm.; diam. 1.9 mm. There is considerable diversity in the expression of the incised spirals in the several specimens; in one they are almost obsolete on the base. One individual is decidedly more obese than the rest (fig. 3). It has six post-nuclear whorls and measures: long. 4.8 mm.; diam. 2.5 mm. Another badly-worn individual from Japan was labeled *Vanesia erarata* A. Adams.

**ODOSTOMIA (ODETTA) LECTISSIMA, new species.**

Plate XXIII, fig. 3.

Shell elongate, ovate, milk-white. Nuclear whorls moderately large, almost buried in the first post-nuclear whorls, only the tumid periphery of the last volution and a mere speck of another turn are visible. Post-nuclear whorls inflated and strongly, slopingly shouldered, ornamented between the sutures by five spiral keels, the posterior one of which is much less developed than the rest and occupies the space at the suture on the shoulder. The other four are strong, well rounded, subequal and subequally spaced. The first one is at the shoulder, and the anterior edge of the fourth bounds the peripheral sulcus. The sulci between these spiral cords are deep, a little wider than the cords and crossed by very regular and regularly spaced, backward-slanting, raised axial threads; which, were they not interrupted by the spiral keels, would form continuous lines from the summits to the umbilical region. Base of the last whorl short, well rounded, somewhat pinched behind the columella but not perforated, sculptured like the space between the sutures, having five spiral keels. Aperture large, somewhat produced at the junction of the outer lip and the columella; posterior angle obtuse; outer lip thin, decidedly wavy in outline, showing the external sculpture within; columella straight, slender, somewhat revolute, with a weak fold near its insertion which is not apparent when the aperture is viewed squarely; parietal wall covered by a thin callus.

The type belongs to the Pætel collection and is from Japan. It has four post-nuclear whorls and measures: long. 1.7 mm.; diam. .1 mm.

**ODOSTOMIA (ODETTA) FELIX, new species.**

Plate XXI, fig. 2.

Shell broadly elongate-conic, turritid, subdiaphanous. Nuclear whorls small, almost completely obliquely immersed, only part of the last rounded volution is visible above the first of the later whorls. Post-nuclear whorls somewhat inflated, well rounded, moderately shouldered, marked by strong, equally developed, spiral keels which are separated by subequal, deep, rounded sulci. The latter are somewhat

broader than the keels and crossed by many, very slender raised axial threads. Three keels are present upon the first and second, on the third a fourth keel appears partly at the suture, but the greater part of it is covered up by the summit of the succeeding volution. The penultimate whorl has four keels, the posterior one of which marks the summit and is a little wider than the rest and somewhat flattened. Periphery of the last whorl marked by a sulcus. Base well rounded, attenuated, ornamented like the spaces between the sutures, having six spiral keels. These keels, as well as the sulci, gradually diminish in breadth from the periphery to the umbilical region. Aperture oval, outer lip thin, showing the external sculpture within; columella rather heavy, somewhat curved, backed up by the attenuated base and provided with a strong oblique fold at its insertion; parietal wall covered by a thin callus.

The type belongs to the Pætel collection and comes from Japan. It has five and one-half post-nuclear whorls and measures: long, 2.6 mm.; diam., 1.3 mm. It was labeled *Evalea lirata* A. Adams, but is not that species. The U. S. National Museum has two specimens of *Odostomia* (*Odetta*) *lirata* A. Adams, from the author, which are much smaller, more slender, more oval, and less prominently sculptured than the present species.

#### ODOSTOMIA (ODETTA) CIRCINATA A. Adams.

Plate XXIII, fig. 6.

*Oscilla circinata* A. ADAMS, Proc. Zool. Soc., 1867, p. 311.

Shell elongate-oval, subdiaphanous. Nuclear whorls small, almost completely immersed in the first post-nuclear whorl, only the rounded two-thirds of the last volution are visible, and those indicate that the axis of the nuclear turns must be at a right angle to the axis of the later whorls. Post-nuclear whorls moderately well rounded, the last one somewhat inflated, shouldered, marked by strong, broadly rounded, subequal and subequally spaced spiral keels, which are separated by deep, rounded sulci, which are about as wide as the keels. The sulci are crossed by extremely fine and very closely spaced axial raised threads which pass up on the sides of the spiral keels, but do not cross their summits. The second and third whorls have three keels between the sutures. On the third the posterior keel at the summit of the whorl, which is a little wider than the other two, shows a spiral striation on its middle. This grows gradually stronger as the shell advances, until on the penultimate whorl it has divided this keel into two, the posterior one of which is a little less developed than the anterior one, which resembles the other between the sutures. The summit of the last whorl falls considerably below the periphery, showing five spiral keels between the sutures on the penultimate whorl. Periphery of the last whorl sulcate, sulcus like the rest and similarly sculptured.

Base well rounded, somewhat attenuated anteriorly, sculptured like the spaces between the sutures, having seven spiral keels; these keels diminish somewhat in size from the periphery to the umbilical area. Aperture subovate, posterior angle acute, outer lip thin, wavy, showing the external sculpture within, columella decidedly curved, reinforced anteriorly by the attenuated base, provided with a very strong, acute, oblique fold near its insertion; parietal wall covered by a thin callus.

There are two specimens of this species in the Pætel collection. The one described and figured has five post-nuclear whorls and measures: long. 2.1 mm.; diam. 1 mm. This species closely resembles *Odostomia* (*Evalea*) *lirata* A. Adams. It is, however, more compact than that species and has two more spiral keels on the base. *O. (E.) lirata* is not an *Evalea*, but belongs to the subgenus *Odetta*; the name should read *Odostomia* (*Odetta*) *lirata* A. Adams.

**ODOSTOMIA (EVALEA) SITKAENSIS Clessin.**

Plate XVII, fig. 8.

*Odostomia sitkaensis* CLESSIN, Mart. Chem. Conch. Cab., 2d Ed., Pyramid., 1900, p. 121, pl. xxx, fig. 1.

Shell elongate-conic, very regular in outline, yellowish white, shining. Nuclear whorls almost completely immersed in the first of the succeeding volution. Post-nuclear whorls moderately rounded, rather high between the sutures, slightly shouldered at the summits, marked by many fine lines of growth and numerous fine wavy spiral striations; the latter are more regularly developed and distributed than the lines of growth. (Our figure does not show the spiral markings.) The periphery of the last whorl marks the greatest diameter of the shell. The base, though rather long, falls off rather abruptly at the periphery, then tapers gradually to the anterior end of the columella; it is marked like the spaces between the sutures. Aperture large, oval; posterior angle acute, outer lip decidedly curved, almost patulous, thin; columella long, slender, gently curved, and somewhat reflected, provided with a moderately strong, oblique fold near its insertion. Parietal wall without callus.

The Berlin collection contains two specimens of this species—No. 26232, which were collected by F. Schmidt, at Sitka, Alaska. We have described and figured the most perfect of the two, which we consider Clessin's type. This specimen measures: long. 4 mm.; diam. 2 mm. Clessin's figure is worthless, as usual.

**ODOSTOMIA (EVALEA) CULTA**, new species.

Plate XXVI, fig. 9.

Shell regularly conic, umbilicated, yellowish white. Nuclear whorls apparently planorboid, very obliquely, almost completely, immersed in the first of the later whorls, only a portion of the last volution being visible. Post-nuclear whorls rather high between the sutures, slightly rounded (almost flattened), and subtabulately shouldered at the summits, marked by fine lines of growth and very many subequal, wavy, closely spaced striations. (These have not been indicated in our drawing.) The whorls are somewhat angulated at the periphery and the summit of succeeding whorls falls a little anterior to the periphery, which gives the sutures a decidedly channeled effect. Base of the last whorl large, rather prolonged, well rounded, marked by spiral striations which are equally as abundant as those between the sutures but somewhat stronger. Aperture moderately large, suboval, somewhat effuse anteriorly, posterior angle obtuse, outer lip thin (fractured), columella slender, curved, reflected partly over the moderately large umbilicus, provided with a strong, acute, oblique fold near its insertion; parietal wall covered by a thin callus.

The type was collected at Hakodate, Japan, by Hilgendorf. It has six post-nuclear whorls and measures: long. 4 mm.; diam. 1.8 mm.

This is a moderately large species characterized by its spiral striations, regular conic outline, and the constricted appearance of the whorls at the channeled sutures. It is evidently related to *Odostomia* (*Evalea*) *arcuata* A. Adams.

**ODOSTOMIA (AMAURA) MARTENSI**, new name.

Plate XXV, fig. 5.

*Odostomia curta* CLESSIN, Mart. Chem. Conch. Cab., 1900, p. 116, pl. xxviii, fig. 3.

Not *Odostomia curtum* DESHAYES, An. Sans. Vert. Paris Basin, 1864, p. 551, pl. xix, figs. 9-11.

Shell ovoid, heavy, yellowish white, nuclear whorls small, almost completely immersed in the first of the succeeding volutions. Post-nuclear whorls increasing regularly and rapidly in size, inflated, subtabulately shouldered at the summit, marked by numerous fine lines of growth and equally abundant, closely placed, wavy, spiral striations. These lines of growth and spiral markings give the surface a finely reticulated appearance when viewed under high magnification. (We have omitted this sculpture in our drawing, which should be considered as an outline sketch only.) Periphery and base of the last whorl decidedly rounded and inflated, marked like the space between the sutures. Aperture large, suboval, slightly effuse anteriorly, posterior angle acute; outer lip sharp at the edge but thick within; columella very strong, curved, reenforced by the body whorl from which the

slightly reflected edge is separated only by a narrow line. A strong oblique fold, not completely visible when the aperture is viewed squarely, is located a little anterior to the insertion of the columella.

The type has five post-nuclear whorls and measures: long. 5.3 mm.: diam. 3.1 mm. Clessin gives the diam. as 1.3, evidently a transposition. He also cites the registration No. as 36336, while it should be 36335. His figure *almost* represents this species. The type comes from Killisnoo, Alaska, not Japan.

**ODOSTOMIA (AMAURA) KRAUSEI** Clessin.

Plate XXIII, fig. 2.

*Odostomia krausei*, CLESSIN, Mart. Chem. Conch. Cab., 2d ed., Pyramid., 1900, p. 115, pl. XXVIII, fig. 1.

Shell elongate-conic, thick and heavy, rough through erosion, yellowish white. Nuclear whorls decollated in the type (judging from the pit in the apex they are probably deeply, obliquely immersed). Post-nuclear whorls only moderately rounded, somewhat shouldered at the summit (surface decidedly eroded). Periphery and base of the last whorl well rounded, the latter with a minute umbilical chink. Aperture auricular, somewhat effuse anteriorly, posterior angle scarcely acute; outer lip very thick; columella thick, reflexed, with a broad, strong, oblique fold, a little anterior to its insertion; parietal wall covered by a thick callus.

The type has six post-nuclear whorls and measures: long, 9.9 mm.: diam. 5 mm. It was collected by Krause at Killisnoo, which is in Alaska and not in Japan as stated by Clessin. The registration number of his type in the Berlin Museum is also wrong; the specimen described and figured by him is 36335 and not 36336 as given in his account of the species.

The U. S. National Museum has two lots, one specimen, 159454, from Killisnoo, collected by Krause, and another, No. 159471, from Kadiak. They are both much eroded and can furnish no additional data to our text.

Clessin's figure cited above, will not enable any one to recognize this form.

**ODOSTOMIA (ODOSTOMIA) DESIMANA**, new name.

Plate XXV, fig. 3. Plate XXVI, fig. 2.

*Odostomia lactea* DUNKER, Mal. Blätt., VI, 1860, p. 234; also Moll. Jap., 1861, p. 17, pl. XI, fig. 4, not *Odostomia lactea* J. G. JEFFREYS, Ann. Mag. Nat. Hist., II, 1848, p. 348 (= *Turbonilla lactea* LINNÆUS), nor *Odostomia lactea* ANGAS, Proc. Zool. Soc., 1867, p. 112, pl. XIII.

Shell regularly elongate-conic, milk-white. Nuclear whorls small, obliquely almost completely immersed in the first of the succeeding whorls, only the periphery of the last two being visible. Post-nuclear

whorls rather high between the sutures, very slightly rounded, slightly angulated at the periphery and scarcely at all shouldered, marked by scarcely perceptible lines of growth, and here and there by a faint trace of some very fine microscopic spiral lines. The summit of succeeding whorls falls somewhat anterior to the periphery of the preceding turns, which gives a slightly constricted appearance at the well-impressed suture. Periphery of the last whorl faintly angulated; base large, well rounded, narrowly umbilicated and somewhat effuse at the junction of the lip and columella, posterior angle acute, outer lip (fractured), thin, columella long, slender, almost straight, somewhat revolute, bearing a strong oblique fold near its insertion; parietal wall covered by a thin callus.

The specimen described is Dunker's type which comes from Desima, Japan. It is not quite mature, having seven and one-half post-nuclear whorls and measures: long. 5.3 mm.; diam. 2.2 mm. The Dunker collection contains an additional specimen from Nagasaki, Japan, of which we also give a figure. This is adult. It has nine post-nuclear whorls and measures: long. 6.7 mm.; diam. 2.8 mm. The chief difference between this and the young shell lies in the aperture, the outer lip in this case being rather patulous. The Pætel collection has one specimen from Nagasaki, Japan.

**ODOSTOMIA (ODOSTOMIA) MAURITIANA, new species.**

Plate XXVI, fig. 6.

Shell small, umbilicated, elongate-ovate conic, semitransparent, polished. Nuclear whorls two and one-half, moderately large, helicoid, elevated, about one-fifth immersed in the first of the succeeding whorls and having their axis at a right angle to them. Post-nuclear whorls flattened, angulated at the periphery and weakly shouldered at the summit; the latter falls somewhat anterior to the periphery of the preceding whorl and lends to it a somewhat constricted appearance at the well-impressed suture. The whorls are marked by extremely fine, closely placed, wavy spiral striations, which are visible only under very high magnification. Periphery of the last whorl somewhat angulated. Base very broad, gently rounded, somewhat pinched at the narrow umbilicus. Aperture elongate-ovate, somewhat prolonged at the junction of the outer lip and columella; posterior angle acute, outer lip thin, somewhat effuse, columella slender, decidedly curved, slightly revolute, provided with a prominent oblique fold at its insertion; parietal wall covered by a strong callus which lends the peritreme an almost continuous appearance.

The specimen described and figured belongs to the Pætel collection and comes from Mauritius. It has five post-nuclear whorls and measures: long. 2.1 mm.; diam. 1.1 mm.

## ODOSTOMIA (ODOSTOMIA) HILGENDORFI Clessin.

Plate XXIV, fig. 5.

*Odostomia hilgendorfi* CLESSIN, Mart. Chem. Conch. Cab., 2d ed., Pyramid., 1900, p. 119, pl. xxviii, fig. 5.

Shell broadly elongate-conic, very regularly tapering, subturritid, milk-white. Nuclear whorls two and one-half, small, helicoid, well rounded, moderately elevated, about one-third immersed in the first of the later whorls, having their axis almost at a right angle to them. Post-nuclear whorls rather high between the sutures, flattened, subtabulately shouldered at the summits and decidedly angulated at the periphery, marked by lines of growth and extremely fine, microscopic, closely placed, wavy, spiral striations. The shouldered summits of succeeding whorls fall quite a little anterior to the angulated periphery, giving the whorls a decidedly constricted appearance at the sutures, which appears decidedly channeled. Periphery of the last whorl decidedly angulated. Base slightly rounded, marked like the spaces between the sutures. Aperture suboval, posterior angle obtuse (outer lip fractured), thick; columella strong, curved, provided with a prominent lamellar plate at its insertion; parietal wall covered by a moderately thick callus.

The specimen described is Clessin's type and was collected by Hilgendorf at Hakodate. It has seven post-nuclear whorls and measures: long. 5 mm.; diam. 2.4 mm. There is a possibility that this may be one of A. Adams's species of *Odostomia*. The description of *Odostomia subangulata* A. Adams reads not unlike this, but absence of measurements, etc., make it impossible to be certain. Clessin's figures, as usual, fail to delineate the characters of this form. No trace of the peripheral angulations is shown.

## ODOSTOMIA (ODOSTOMIA) LIMPIDA, new species.

Plate XXVI, fig. 7.

Shell slender, elongate-conic, semitranslucent, shining. Nuclear whorls moderately large, almost completely obliquely immersed in the first of the succeeding whorls; the peripheral edge only of the last volution is visible above this. Post-nuclear whorls rather high between the sutures, slightly rounded (almost flattened), faintly shouldered at the summit, apparently without axial or spiral sculpture. The whorls are feebly angulated at the periphery, and the summits of succeeding turns fall a little anterior to it, which renders the sutures well impressed. Base of the last whorl large, rounded, very narrowly umbilicated. Aperture large, subovate, somewhat produced at the junction of the outer lip and columella, posterior angle acute, outer lip thin; columella slender, decidedly curved and somewhat

revolute, provided with a prominent lamellar fold at its insertion; parietal wall covered by a thin callus.

The type belongs to the Pætel collection and is from Japan. It has six post-nuclear whorls and measures: Long., 3.6 mm.; diam., 1.5 mm. It was labeled *Amathis pellucida* A. Adams. This appears to be a *nomen nudum*, as the only reference<sup>a</sup> to that we have been able to find gives the following statement: *Amathis pellucida* A. Adams = *Menestho pellucida* A. Adams.<sup>b</sup> It is very probable that the part of the manuscript relating to the species was omitted. It is not *Voluta* (= *Odostomia*) *pellucida* Dillwyn.<sup>c</sup>

A badly worn shell, perhaps an *Odostomia* s. s., very elongate and umbilicate, bears the name *Amathis concinna* A. Adams, and comes from Japan. *Amathis concinna* appears to be a *nomen nudum* for the reasons cited under *Odostomia* (*Odostomia*) *limpida*.

#### ODOSTOMIA (HEIDA) PANAMENSIS Clessin.

Plate XXVI, fig. 4.

*Odostomia panamensis* CLESSIN, Mart. Chem. Conch. Cab., 2d ed., Pyramid. 1900, p. 120; pl. xxviii, fig. 9.

Shell small, heavy, elongate-ovate, whorls increasing regularly in size, milk white, shining. Nuclear whorls small, almost completely obliquely immersed in the first of the succeeding volutions. Post-nuclear whorls moderately and evenly rounded, of porcellaneous texture, without any apparent marking, separated by well marked sutures. Periphery of the last whorl full and rounded. Base inflated, well rounded. Aperture small, decidedly rissoid, almost channeled anteriorly, posterior angle acute; outer lip decidedly curved backward anteriorly, very thick within but beveled to form a sharp edge; columella extremely short, somewhat reflected and connected posteriorly with the very strong parietal callus, which is fully as thick as the edge of the outer lip and connects with it at the posterior angle of the aperture, thus forming a complete peristome. A prominent oblique fold is present on and a little anterior to the insertion of the columella.

There are two specimens of this species in the Berlin collection from Panama. We have considered the best preserved individuals, which evidently served Clessin for his description and figure as his type, and have here rediagnosed and figured it. It has six post-nuclear whorls and measures: Long., 3.1 mm.; diam., 1.5 mm.

Clessin for some unaccountable reason changed the characters of the aperture in the above-cited figure to harmonize with the typical *Odostomia* aperture. He seems to have failed entirely in recognizing the peculiarities of the present species.

<sup>a</sup>Ann. Mag. Nat. Hist., VIII, 1861, p. 304.

<sup>b</sup>Ann. Mag. Nat. Hist., 1860.

<sup>c</sup>Cat. I, 1817, p. 508.

*O. (Heida) panamensis* Clessin represents the first member of this subgenus on the west coast of America; several additional species inhabit the southeast coast.

#### GEOGRAPHICAL TABLE.

##### AFRICA.

*Turbonilla (Strioturbonilla) securo*, new name.  
*Odostomia (Odostomia) mauritiana*, new species.

##### AMERICA.

###### ATLANTIC COAST.

###### West Indies.

*Pyramidella (Triptychus) niveus* Mörch.  
*Odostomia (Miralda) jamaicensis* Clessin.

###### Mexico.

*Turbonilla (Chemnitzia) crenulata* Menke.

###### PACIFIC COAST.

###### Alaska.

*Odostomia (Evalea) sitkaensis* Clessin.  
*Odostomia (Amaura) martensi*, new name.  
*Odostomia (Amaura) krausei* Clessin.

###### Mexico.

*Pyramidella (Longchæus) bicolor* Menke.  
*Pyramidella (Pharcidella) hastata* A. Adams.  
*Pyramidella (Pharcidella) noffati*, new name.

###### Panama.

*Odostomia (Heida) panamensis* Clessin.

##### AUSTRALIA.

*Pyramidella (Tiberia) pusilla jacksonensis*, new subspecies.

##### CHINA.

*Pyramidella (Syrnola) brunnea* A. Adams.

##### HAWAII.

*Pyramidella (Cossmannica) aciculata* A. Adams.

##### JAPAN.

*Pyramidella (Tiberia) pulchella* A. Adams.  
*Pyramidella (Tiberia) japonica*, new species.  
*Pyramidella (Tiberia) pusilla* A. Adams.  
*Pyramidella (Tiberia) trifasciata* A. Adams.  
*Pyramidella (Tiberia) dunkeri*, new name.  
*Pyramidella (Actæopyramis) erinia* Lischke.  
*Pyramidella (Actæopyramis) fulva* A. Adams.

- Pyramidella (Actæopyramis) casta* A. Adams.  
*Pyramidella (Actæopyramis) lauta* A. Adams.  
*Pyramidella (Actæopyramis) amoena* A. Adams.  
*Pyramidella (Actæopyramis) punctigera* A. Adams.  
*Pyramidella (Actæopyramis) digitalis*, new species.  
*Pyramidella (Styloptygma) serotina* A. Adams.  
*Pyramidella (Syrnola) cinnamomea* A. Adams.  
*Pyramidella (Syrnola) brunnea* A. Adams.  
*Pyramidella (Iphiana) lischkei*, new species.  
*Pyramidella (Iphiana) tenuisculpta* Lischke.  
*Pyramidella (Agatha) virgo* A. Adams.  
*Turbonilla (Chemnitzia) abseida*, new species.  
*Turbonilla (Chemnitzia) dunkeri* Clessin.  
*Turbonilla (Chemnitzia) approximata*, new species.  
*Turbonilla (Chemnitzia) multigyrata* Dunker.  
*Turbonilla (Chemnitzia) acosmia*, new species.  
*Turbonilla (Chemnitzia) actopora*, new species.  
*Turbonilla (Chemnitzia) infantula*, new species.  
*Turbonilla (Strioturbonilla) monocycla* A. Adams.  
*Turbonilla (Pyrgisculus) candidissima*, new name.  
*Turbonilla (Pyrgiscus) mumia* A. Adams.  
*Turbonilla (Cingulina) cingulata* Dunker.  
*Turbonilla (Cingulina) cingulata laticingula*, new subspecies.  
*Turbonilla (Mormula) aulica*, new name.  
*Turbonilla (Mormula) philippiana* Dunker.  
*Turbonilla (Lancella) bella*, new species.  
*Turbonilla (Babella) exaltior*, new name.  
*Odostomia (Trabecula) tantilla* A. Adams.  
*Odostomia (Parthenina) meta*, new species.  
*Odostomia (Chrysallida) dur*, new species.  
*Odostomia (Pyrgulina) lecta*, new species.  
*Odostomia (Pyrgulina) alveata* A. Adams.  
*Odostomia (Egilina) mariella* A. Adams.  
*Odostomia (Miralda) diadema* A. Adams.  
*Odostomia (Miralda) gemma* A. Adams.  
*Odostomia (Miralda)*, species?  
*Odostomia (Menestho) exaratiissima*, new species.  
*Odostomia (Odetta) circumata* A. Adams.  
*Odostomia (Odetta) lirata* A. Adams.  
*Odostomia (Odetta) felix*, new species.  
*Odostomia (Odetta) lectissima*, new species.  
*Odostomia (Evalea) culla*, new species.  
*Odostomia (Odostomia) hilgendorfi* Clessin.  
*Odostomia (Odostomia) limpida*, new species.  
*Odostomia (Odostomia) desimana*, new species.  
*Odostomia (Odostomia)*, species?

#### SOUTH SEA ISLANDS.

- Pyramidella (Cossmannica) aciculata* A. Adams.  
*Turbonilla (Nisiturreis) crystallina*, new species.  
*Turbonilla (Chemnitzia) garrettiana*, new name.  
*Odostomia (Pyrgulina) amanda* Garrett.  
*Odostomia (Pyrgulina) denserostata* Garrett.  
*Odostomia (Pyrgulina) denserostata upoluensis*, new subspecies.

## EXPLANATION OF PLATES.

The measurements cited after the name refer to the axial length of the specimen.

## PLATE XVII.

- FIG. 1. *Turbonilla* (*Pyrgiscus*) *mumia* A. Adams; 3.3 mm.; p. 343.  
2. *Odostomia* (*Miralda*) *diadema* A. Adams; 2.3 mm.; p. 356.  
3. *Turbonilla* (*Pyrgisculus*) *candidissima*, new name; 6.7 mm.; p. 342.  
4. *Odostomia* (*Chrysallida*) *dux*, new species; type; 1.8 mm.; p. 350.  
5. *Pyramidella* (*Styloptygina*) *serotina* A. Adams; 3 mm.; p. 334.  
6. *Odostomia* (*Miralda* ?) *jamaicensis* Clessin; type; 2.1 mm.; p. 355.  
7. *Turbonilla* (*Nisiturreis*) *crystallina*, new species; type; 4.5 mm.; p. 341.  
8. *Odostomia* (*Evalea*) *sitkaensis* Clessin; type; 4 mm.; p. 360.  
9. *Turbonilla* (*Babella*) *cælatior*, new name; 4.4 mm.; p. 347.

## PLATE XVIII.

- FIG. 1. *Odostomia* (*Pyrgulina*) *densecostata upoluensis*, new subspecies; type; 3.7 mm.; p. 351.  
2. *Pyramidella* (*Agatha*) *virgo* A. Adams; 13.7 mm.; p. 335.  
3. *Odostomia* (*Pyrgulina*) *amanda* Garrett; type; 3 mm.; p. 353.  
4. *Odostomia* (*Pyrgulina*) *densecostata* Garrett; type; 4 mm.; p. 350.  
5. *Turbonilla* (*Mormula*) *philippiana* Dunker; 5.3 mm.; p. 345.

## PLATE XIX.

- FIG. 1. *Pyramidella* (*Actæopyramis*) *amana* A. Adams; 7 mm.; p. 330.  
2. *Pyramidella* (*Actæopyramis*) *punctigera* A. Adams; 5.4 mm.; p. 331.  
3. *Odostomia* (*Menestho*) *exaratisissima*, new name; 4.8 mm.; p. 357.  
4. *Pyramidella* (*Actæopyramis*) *casta* A. Adams; 11.3 mm.; p. 329.  
5. *Pyramidella* (*Actæopyramis*) *lauti* A. Adams; 7 mm.; p. 329.  
6. *Pyramidella* (*Actæopyramis*) *digitalis*, new species; type; 2.2 mm.; p. 331.  
7. *Odostomia* (*Menestho*) *exaratisissima*, new name; 4.2 mm.; p. 357.

## PLATE XX.

- FIG. 1. *Turbonilla* (*Chemnitzia*) *approximata*, new species; type; 8.2 mm.; p. 337.  
2. *Turbonilla* (*Chemnitzia*) *infantula*, new species; type; 2.1 mm.; p. 338.  
3. *Turbonilla* (*Chemnitzia*) *dunkeri* Clessin; type; 6.2 mm.; p. 336.  
4. *Turbonilla* (*Chemnitzia*) *multigyrata* Dunker; type; 11.5 mm.; p. 335.  
5. *Turbonilla* (*Chemnitzia*) *acosmia*, new species; type; 8.4 mm.; p. 339.  
6. *Turbonilla* (*Chemnitzia*) *actopora*, new species; type; 6.8 mm.; p. 338.

## PLATE XXI.

- FIG. 1. *Turbonilla* (*Cingulina*) *cingulata* Dunker; type; 7.4 mm.; p. 344.  
2. *Odostomia* (*Odetta*) *felix*, new species; type; 2.6 mm.; p. 358.  
3. *Turbonilla* (*Cingulina*) *cingulata laticingula*, new subspecies; type; 4 mm.; p. 344.  
4. *Turbonilla* (*Chemnitzia*) *absida*, new species; type; 8.4 mm.; p. 337.  
5. *Turbonilla* (*Chemnitzia*) *garrettiana*, new name; type; 7.4 mm.; p. 339.  
6. *Turbonilla* (*Chemnitzia*) *crenulata* Menke; type; 8.6 mm.; p. 340.

## PLATE XXII.

- FIG. 1. *Odostomia* (*Miralda*) *gemma* A. Adams; 3.2 mm.; p. 356.  
 2. *Odostomia* (*Pyrgulina*) *lecta*, new species; type; 3.4 mm.; p. 352.  
 3. *Odostomia* (*Trabecula*) *tantilla* A. Adams; 2.6 mm.; p. 348.  
 4. *Odostomia* (*Egilina*) *mariella* A. Adams; 1.8 mm.; p. 354.  
 5. *Odostomia* (*Pyrgulina*) *alveata* A. Adams; 2 mm.; p. 351.  
 6. *Turbonilla* (*Lancella*) *bella*, new species; type; 7.5 mm.; p. 346.  
 7. *Turbonilla* (*Mormula*) *aulica*, new name; type; 9.6 mm.; p. 345.  
 8. *Turbonilla* (*Strioturbonilla*) *monocycla* A. Adams; 4.3 mm.; p. 342.

## PLATE XXIII.

- FIG. 1. *Pyramidella* (*Actæopyramis*) *eximia* Lischke; cotype?; 18.1 mm.; p. 327.  
 2. *Odostomia* (*Amaura*) *krausei* Clessin; type; 9.9 mm.; p. 362.  
 3. *Odostomia* (*Odetta*) *lectissima*, new species; type; 1.7 mm.; p. 358.  
 4. *Pyramidella* (*Actæopyramis*) *fulva* A. Adams; 20.3 mm.; p. 328.  
 5. *Odostomia* (*Parthenina*) *meta*, new species; type; 2.1 mm.; p. 349.  
 6. *Odostomia* (*Odetta*) *circinata* A. Adams; 2.1 mm.; p. 359.

## PLATE XXIV.

- FIG. 1. *Pyramidella* (*Cossmannica*) *aciculata* A. Adams; 14.2 mm.; p. 326.  
 2. *Pyramidella* (*Tiberia*) *japonica*, new species; type; 6.1 mm.; p. 324.  
 3. *Turbonilla* (*Nisiturris*) *crystallina*, new species, nucleus much enlarged; p. 341.  
 4. *Pyramidella* (*Syrnola*) *brunnea* A. Adams; 17.6 mm.; p. 332.  
 5. *Odostomia* (*Odostomia*) *hilgendorfi* Clessin; type; 5 mm.; p. 364.  
 6. *Pyramidella* (*Tiberia*) *pusilla* A. Adams; 6.4 mm.; p. 324.  
 7. *Pyramidella* (*Syrnola*) *brunnea* A. Adams; a portion much enlarged to show spiral sculpture; p. 332.  
 8. *Pyramidella* (*Cossmannica*) *aciculata* A. Adams; a portion much enlarged to show spiral sculpture; p. 326.

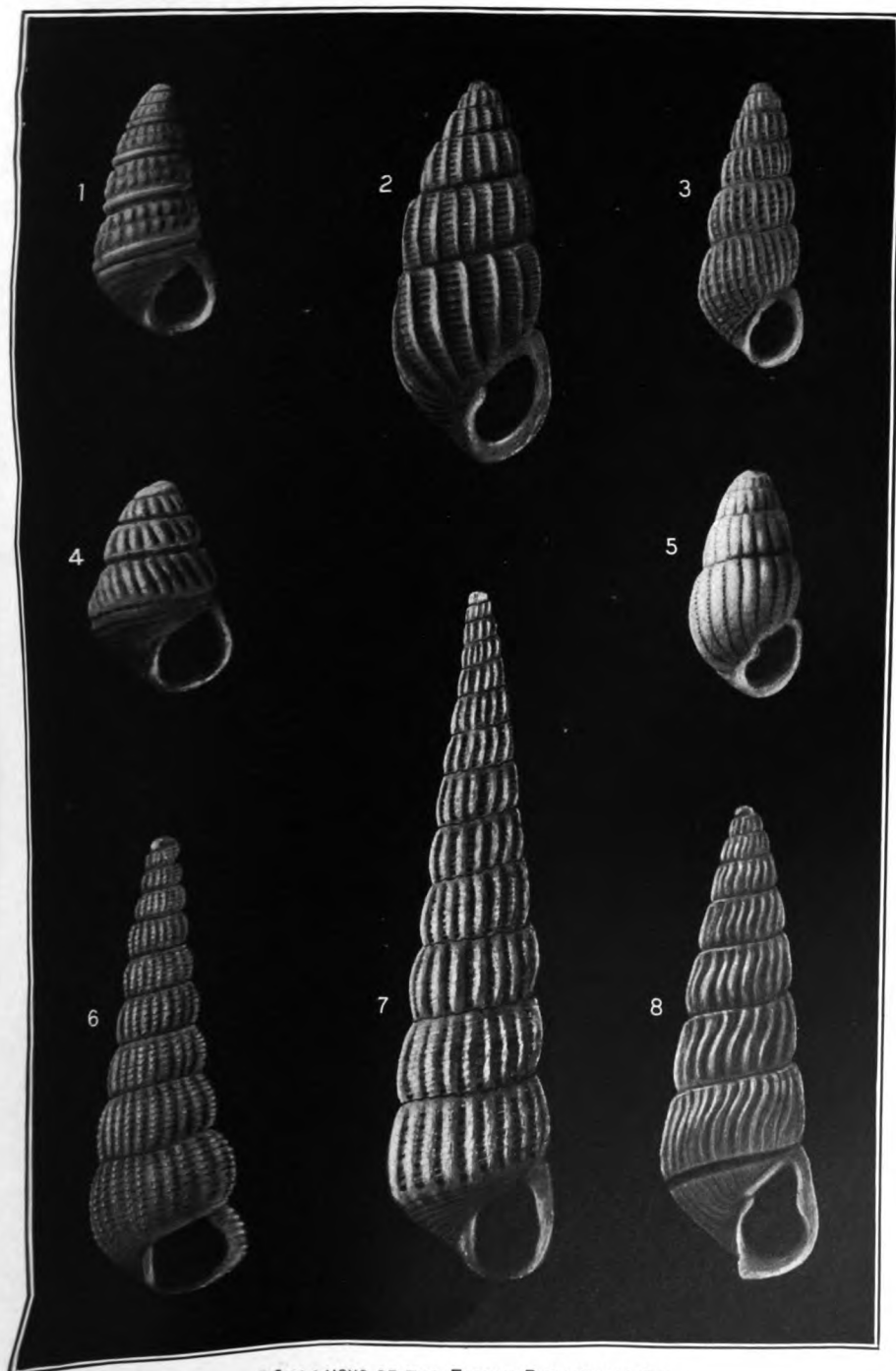
## PLATE XXV.

- FIG. 1. *Pyramidella* (*Iphiana*) *lischkei*, new species; type; 4.6 mm.; p. 333.  
 2. *Pyramidella* (*Tiberia*) *dunkeri*, new name; type; 5 mm.; p. 326.  
 3. *Odostomia* (*Odostomia*) *desimana*, new name; 6.7 mm.; p. 362.  
 4. *Pyramidella* (*Tiberia*) *pulchella* A. Adams; 12.2 mm.; p. 323.  
 5. *Odostomia* (*Amaura*) *martensi*, new name; type; 5.3 mm.; p. 361.  
 6. *Pyramidella* (*Tiberia*) *trifasciata* A. Adams; 6 mm.; p. 325.

## PLATE XXVI.

- FIG. 1. *Pyramidella* (*Syrnola*) *cinnamomea* A. Adams; 4.2 mm.; p. 332.  
 2. *Odostomia* (*Odostomia*) *desimana*, new name; type; 5.3 mm.; p. 362.  
 3. *Pyramidella* (*Iphiana*) *tenuisculpta* Lischke; 10.4 mm.; p. 334.  
 4. *Odostomia* (*Heida*) *panamensis* Clessin; type; 3.1 mm.; p. 365.  
 5. *Pyramidella* (*Iphiana*) *tenuisculpta* Lischke; a portion much enlarged to show spiral sculpture; p. 334.  
 6. *Odostomia* (*Odostomia*) *mauriliana*, new species; type; 2.1 mm.; p. 363.  
 7. *Odostomia* (*Odostomia*) *limpida*, new species; type; 3.6 mm.; p. 364.  
 8. *Pyramidella* (*Tiberia*) *pusilla jacksonensis*, new subspecies; type; 6.1 mm.; p. 325.  
 9. *Odostomia* (*Erælea*) *culta*, new species; type; 4 mm.; p. 361.

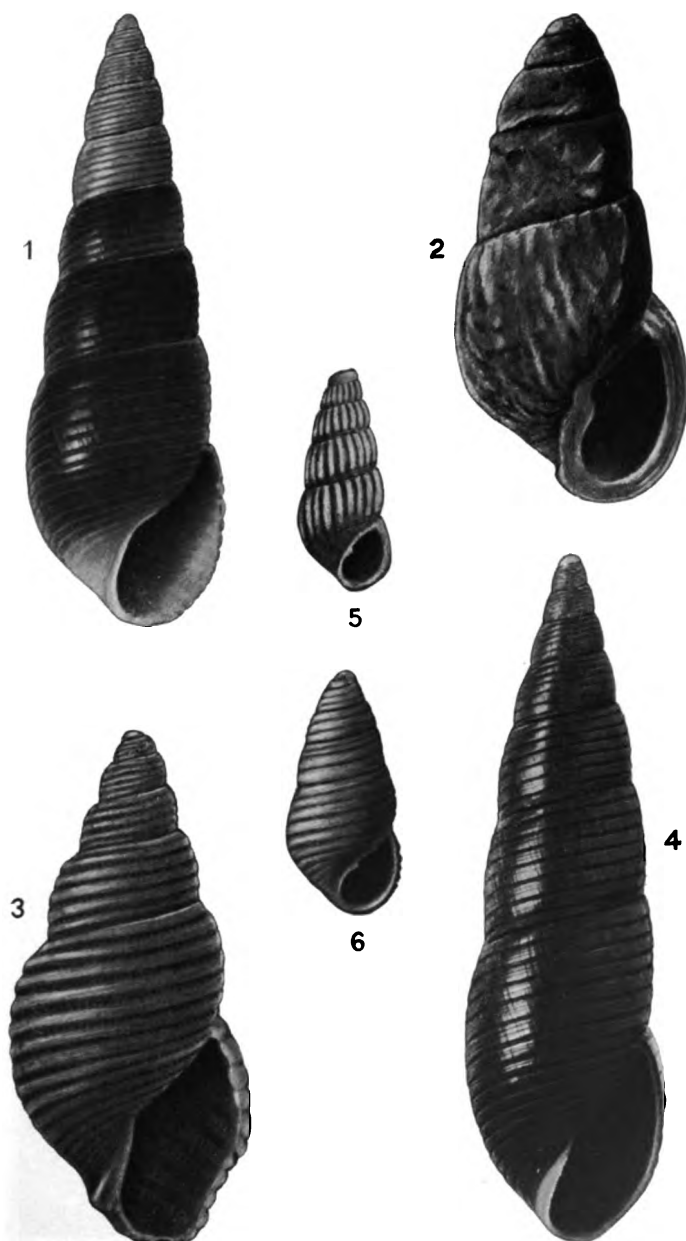




MOLLUSKS OF THE FAMILY PYRAMIDELLIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 369.

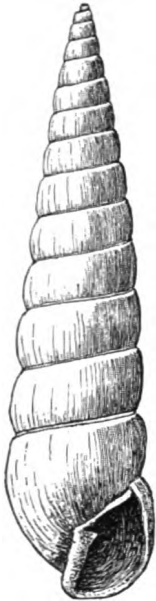




MOLLUSKS OF THE FAMILY PYRAMIDELLIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 369.

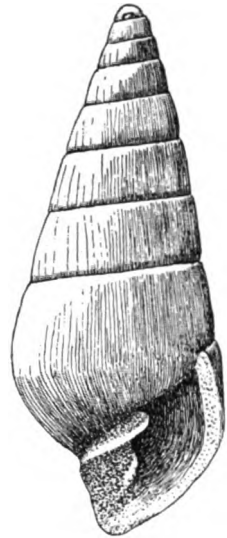




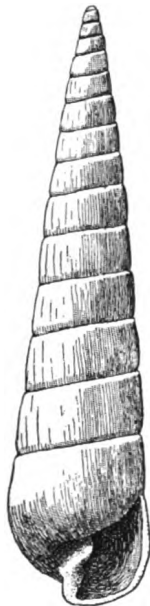
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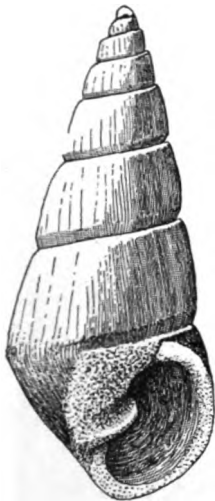
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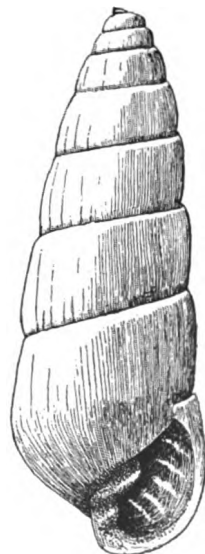
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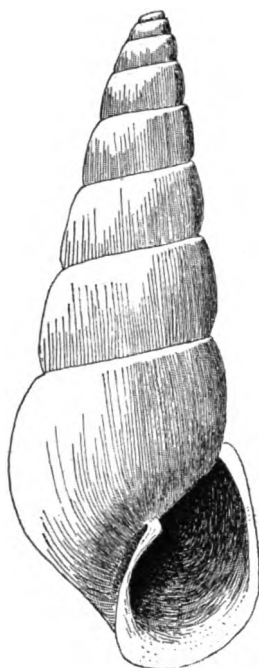
MOLLUSKS OF THE FAMILY PYRAMIDELLIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 369.

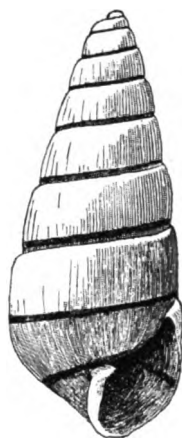




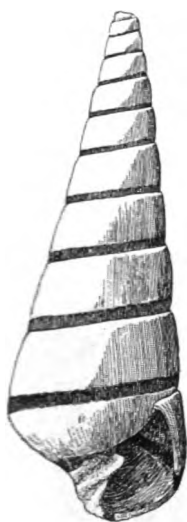
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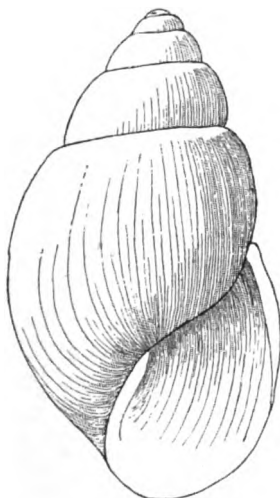
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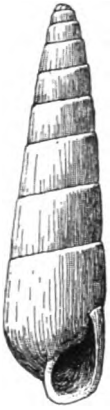


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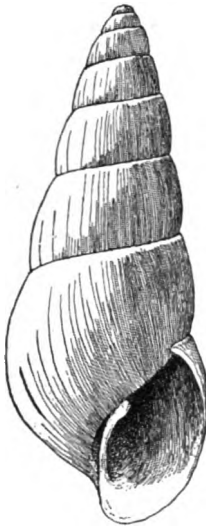
MOLLUSKS OF THE FAMILY PYRAMIDELLIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 369.

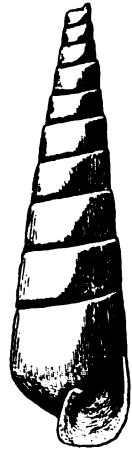




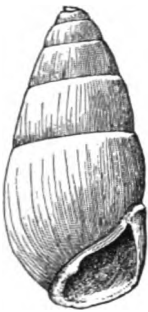
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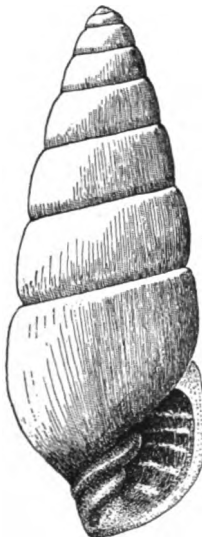
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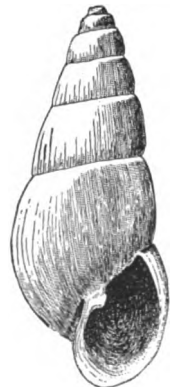
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MOLLUSKS OF THE FAMILY PYRAMIDELLIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 369.



NOTES ON SOUTH AMERICAN GRASSHOPPERS OF THE  
SUBFAMILY ACRIDINÆ (ACRIDIDÆ), WITH DESCRIPTIONS  
OF NEW GENERA AND SPECIES.

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By JAMES A. G. REHN,  
*Of the Academy of Natural Sciences of Philadelphia.*

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The following records and descriptions are based on a portion of a rather large series of South and Central American Acridinæ recently studied by the author, the remainder of the material being considered in another paper.<sup>a</sup>

I wish to thank the officials of the U. S. National Museum for the privilege of examining this very interesting and valuable series.

AMBLYTROPIDIA Stål.

AMBLYTROPIDIA CHAPADENSIS, new species.

*Types*.—Male and female; Chapada, Matto Grosso, Brazil. November. (H. H. Smith.) [Cat. No. 9481, U.S.N.M.]

Belonging to the group containing *A. trinitatis* and *elongata* Bruner and *auriventris* McNeill. From *elongata* it can readily be separated by the heavier form, broader fastigium, more robust caudal limbs, and weaker carination. From *trinitatis* it can be distinguished by the slenderer head, with much less prominent eyes and the shorter and more robust caudal femora. From *auriventris* it can be separated by the same characters that distinguish it from *trinitatis*, and in coloration it appears to be about intermediate between the two. Its closest relationship seems to be with *auriventris*, the head of that species being more compressed, and in that respect closer to *chapadensis*. The width of the head and prominence of the eyes form a good index to the relationship of the species of this small group of the genus, *elongata* representing one extreme and *trinitatis* the other, *chapadensis* and *auriventris* being interpolated between the two in the order named.

Size medium (for the genus); form moderately elongate; surface ruguloso-punctate except the pronotum which is cribriform punctate.

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<sup>a</sup> Proc. Acad. Nat. Sci. Phila., 1906.

Head with the occiput distinctly arched laterad and with a very slight longitudinal curve; fastigium about equal in width to the narrowest space between the eyes, produced cephalad of the cephalic corner of the eyes, a distance somewhat less than the proximal width, distal portion regularly produced with the apex rather bluntly rounded, lateral margins and median longitudinal carina distinct, the latter extending to and over the occiput; lateral foveolæ not distinctly marked; face very distinctly retreating, the angle greater in the male than in the female; frontal costa with the margins subparallel and in a weakened state reaching the clypeus, the intermarginal portion impresso-punctate, but not sulcate; eyes subovoid, more elongate in the male than in the female and twice the length of the infra-ocular sulcus instead of about half again as in the female; antennæ moderately depressed proximad, not expanded, in the male distinctly exceeding the head and pronotum in length. Pronotum distinctly deplane dorsad, greatest width about one and two-thirds in the length; cephalic margin arcuate, caudal margin distinctly, though obtusely, angulate in both sexes, the margins laterad of the angle being slightly emarginate, lateral angles of the disk distinctly carinate, parallel to the first transverse sulcus and very slightly divergent caudad; median carina stronger in the male than in the female, deeply severed by the last transverse sulcus, metazona slightly longer than the prozona; lateral lobes about as deep as the greatest dorsal length of the same. Interspace between the mesosternal lobes quadrate in the male, very slightly longitudinal in the female; metasternal lobes contiguous caudad in the male, separated by a narrow space in the female. Tegmina reaching to the tips of the caudal femora, bearing a slightly rounded costal expansion at the proximal fourth; no distinct intercalary vein present. Cerci rather heavy, short, acute, not exceeding the supranal plate; subgenital plate compressed, the apex carinate dorsad. Caudal femora moderately robust, the dorsal outline distad with a concavity not so distinct on the ventral side, and more apparent in the female than in the male; pagina with the sculpturing distinct and regular; caudal tibiæ bearing eleven (female) or twelve (male) spines on the lateral margins.

General colors russet and vandyke brown mingled and stippled one over the other, the lateral lobes of the pronotum and the pleura darker in the male than in the female, several dark elongate crescentic lines being also present on the occiput of the male; eyes clear russet in the female, speckled with darker in the male. Tegmina very dark, the vandyke brown tone predominating. Caudal femora of the female tawny olive; the pagina with a touch of olive; caudal tibiæ and tarsi very dull purple, the spines tipped with black. Abdomen of the male washed with orange-vermilion. Caudal femora of the male washed ventrad with orange-vermilion, the pagina burnt umber, the

dorsum wood brown;<sup>a</sup> caudal tibiae and tarsi orange-rufous, the spines tipped with black.

*Measurements.*

|                             | Male.      | Female.    |
|-----------------------------|------------|------------|
|                             | <i>mm.</i> | <i>mm.</i> |
| Length of body.....         | 20.2       | 28.8       |
| Length of pronotum.....     | 3.9        | 6.0        |
| Length of tegmen.....       | 15.7       | 22.0       |
| Length of caudal femur..... | 12.0       | 17.0       |

A single specimen has been examined in addition to the types, a female from Sapucay, Paraguay<sup>b</sup> belonging to the Hebard collection. It is somewhat larger than the female type (length of body 34 mm.) but does not appear separable. The caudal angle of the pronotum is broader and more obtuse than in the type, and the metasternal lobes approximate closer caudad than in the typical specimen. The general color is brown, practically uniform all over, the tegmina being, however, somewhat lighter.

ORPHULELLA Stål.

ORPHULELLA GRACILIS Giglio-Tos.

Chapada, Matto Grosso, Brazil. April. (H. H. Smith.) [U.S.N.M.] Two males.

Corumbá, Matto Grosso, Brazil, highland. March. (H. H. Smith.) [U.S.N.M.] Three females.

These specimens are typical of this rather doubtful form, which possibly is only an extreme type of the following species, with sub-obsolete lateral carinae. Giglio-Tos on reexamination decided it to be inseparable, but with a good series of *punctata* in hand it appears to be recognizable.

The original description says, regarding the caudal tibiae, "undique spinis 9," while the material examined shows that nine is the normal number for the external series, but the internal series numbers eleven.

ORPHULELLA PUNCTATA De Geer.

St. Thomas, West Indies. December, 1882. (A. Koebele.) [U.S.N.M.] One male.

Bonito, Pernambuco Province, Brazil. January and February, 1883. (A. Koebele.) Several specimens labeled "Collected on cotton." [U.S.N.M.] Two adult males, four females, three nymphs.

Chapada, Matto Grosso, Brazil. April, August, and September. (H. H. Smith.) [U.S.N.M.] Two males, three females.

<sup>a</sup>This coloration is also found in the female, but not to the extent it is in the male.

<sup>b</sup>March 15, 1905; Foster, No. 102.

Corumbá, Matto Grosso, Brazil. (H. H. Smith.) [U.S.N.M.]  
Four males, one female.

These specimens exhibit considerable variation in structure and in color, as is found in any series of the species. Several of the Corumbá individuals appear to be close to *gracilis*, being slenderer than usual, but the lateral carinæ are not partially obsolete as in that form. As stated above, it is possible that *gracilis* may be only an extreme form of this species.

The specimens from Pernambuco are duller and more uniform than the other individuals, but this is probably due to alcoholic collecting. The Chapada series is more variegated and richly colored than any of the other specimens. The individual from St. Thomas is quite small and rather robust, but does not appear separable when compared with a large series of this species.

#### COCYTOTETTIX Rehn.

1900 *Fenestra* BRUNER (not of Giglio-Tos, 1895), Acc. Gen. Spec. Locusts Argent., pp. 22, 30.

1906. *Cocytotettix* REHN, Proc. Acad. Nat. Sci. Phila., 1906.

#### COCYTOTETTIX LINEARIS, new species.

*Types*.—Male and female; Chapada, Matto Grosso, Brazil. September. (H. H. Smith.) [Cat. No. 8300, U.S.N.M.]

Apparently allied to *C. argentina* (Bruner),<sup>a</sup> but differing in the longer, slenderer tegmina, the slenderer caudal femora, the lack of green on the costal margin of the tegmen and of cinnabar red on the base of the wings.

No close relationship exists with the other two species of the genus—*C. pulchripennis* (Bruner) and *intermedius* (Bruner)—as they both have the tegmina considerably expanded in the male and the wings strongly vermilion or rose-red proximad.

Size medium; form slender; surface slightly rugulose. Head slightly longer than the pronotum, moderately produced in the female, considerably produced in the male, the dorsum when viewed laterad quite flat; fastigium with its greatest width but slightly greater than the interspace between the eyes, the extension beyond the eyes being slightly less than the greatest width, the distal angle acute with the immediate apex blunt, lateral margins elevated and distinct, as is also the median longitudinal carina, which, in a much weaker form, extends caudad over the occiput; face strongly retreating in the male, considerably in the female; lateral foveolæ not distinct, ventrad; frontal costa with the lateral margins parallel ventrad, constricted toward the fastigium, the costa excavated but not sulcate, a trace of a median ridge present dorsad; eyes rather elongate ovoid, about twice the length of

<sup>a</sup> Acc. Gen. Spec. Locusts Argent., p. 31. [Carcaraña, Santa Fé, Argentina.]

the infra-ocular sulcus in both sexes; antennæ about as long as (male) or distinctly shorter (female) than the head and pronotum together, distinctly but not strongly ensiform, more marked in the female than in the male, apex acute. Pronotum moderately deplanate dorsad, the greatest width contained about once and a half in the length in both sexes; cephalic margin subtruncate, caudal obtuse-angular, rather rounded in the male, lateral margins carinate, subparallel; metazona very slightly shorter than the prozona in the male, distinctly, though not greatly so, in the female; median carina very distinct, cut only by the principal sulcus; lateral lobes subquadrate, the greatest dorsal length slightly greater than the depth, ventral angles rectangular. Interspace between the mesosternal lobes slightly longitudinal in the male, very distinctly longitudinal in the female; metasternal lobes contiguous caudad in the male, subcontiguous in the female. Tegmina slender, elongate, exceeding the abdomen considerably and the tips of the caudal femora slightly in both sexes, apex rounded; a broken irregular intercalary vein, more distinct distad and evanescent proximad present in both sexes. Cerci styliform, rather robust, somewhat exceeding the supra-anal plate; subgenital plate produced into a compressed process with an acute apex. Caudal femora slender, moderately inflated in the proximal half; caudal tibiæ bearing eleven or twelve spines on the lateral margins.

General color mars brown dorsad, wood brown ventrad; spines of the caudal tibiæ with blackish tips. The female bears distinct seal brown lines extending from the vertex to the caudal margin of the pronotum mesad of the lateral carinæ, and a parallel pair from the eyes to and over the pleura, where they merge into a single bar. Lateral carinæ of the pronotum and a pair of lines on the head, which are cephalic continuations of the carinal stripes, ochre yellow; ventro-lateral portion of the head and the ventral section of the lateral lobes buff. Caudal femora with the dorsal section of the pagina clouded with dull blue brown.

*Measurements.*

|                              | Male.      | Female.    |
|------------------------------|------------|------------|
|                              | <i>mm.</i> | <i>mm.</i> |
| Length of body .....         | 20.5       | 26.3       |
| Length of pronotum .....     | 3.5        | 4.3        |
| Length of tegmen .....       | 17.5       | 21.2       |
| Length of caudal femur ..... | 13.0       | 16.0       |

Two paratypic females have been examined, one taken in August, the other in September. These specimens both represent the uniform type of coloration exhibited by the male, the August specimen, however, having the ventro-lateral section of the head and the ventral portion of the lateral lobes yellowish, while there are traces of the yellowish lines on the head and pronotum.

## TOXOPTERUS Bolivar.

## TOXOPTERUS MINIATUS Bolivar.

Chapada, Matto Grosso, Brazil. April, November. (H. H. Smith.) [U.S.N.M.] Two males, three females.

The remarks previously made by the author<sup>a</sup> regarding the color variations of this species apply to the material examined in this connection. One male specimen has distinct parallel black lines on the head and flanking the median carina of the pronotum. This phase was also noticed in one specimen from Sapucay, Paraguay. The above record connects the localities from which the species has been recorded, and shows it is apparently of regular occurrence through at least the upper Amazonian and Madieran region and that of the Paraguay as far south at least as the vicinity of Asuncion.

## STAURORHECTUS Giglio-Tos.

## KEY TO THE FORMS.

This key is purely artificial and merely tentative, as two species are only known from one sex, one from the male, the other from the female. Until the unknown sexes are secured no key based on structural characters can be made.

A. Caudal femora without or with rather indistinct pregenicular annuli of yellow. Size medium or large. Tegmina of male slightly exceeding the abdomen.

B. Greatest width of the fastigium considerably greater than the length. Caudal tibiae of female reddish or purplish. Colors green and brown with buff. Form rather robust.

C. Size large; female ranging from 30 to 38 mm. in length of body.

*longicornis* Giglio-Tos.

CC. Size medium; female ranging from 28 to 30 mm. in length of body.

*longicornis variegatus*, new subspecies.

BB. Greatest width of fastigium slightly greater than the length. Caudal tibiae of female glaucous. Colors green and brown without buff. Form slender.....

*glaucipes* Rehn.

AA. Caudal femora with very pronounced pregenicular annuli of yellow. Size small. Tegmina of male much shorter than the abdomen.

*brevipennis*, new species.

## STAURORHECTUS LONGICORNIS Giglio-Tos.

Corumbá, Matto Grosso, Brazil (highland). March. [U.S.N.M.] Two males, three females.

One of the females belongs to the color phase with the dorsum of the pronotum uniform smoke brown, while one has the lateral carinae of the pronotum more constricted than the others.

The records of this species now cover from Caiza, Bolivia, and Corumbá, Brazil, to Cordoba, Argentina.

<sup>a</sup> Proc. Acad. Nat. Sci., Phila., 1906.

**STAURORHECTUS LONGICORNIS VARIEGATUS**, new subspecies.

*Types*.—Male and female; Chapada, Matto Grosso, Brazil. April. (H. H. Smith.) [U.S.N.M., No. 9487.]

This form is a smaller race of *S. longicornis* inhabiting the vicinity of Cuyaba, but the extent of its range is not known. Compared with Corumbá specimens of typical *longicornis*, it shows, in addition to the smaller size, a comparatively more robust form and a slightly broader eye. The color forms found in the typical race are probably all found in this form, two being present in the material examined, types *a* and *c*,<sup>a</sup> the type specimens both belonging to the former.

*Measurements.*

|                              | Male.      | Female.    |
|------------------------------|------------|------------|
|                              | <i>mm.</i> | <i>mm.</i> |
| Length of body .....         | 21.5       | 28.2       |
| Length of pronotum .....     | 4.0        | 5.2        |
| Length of tegmen .....       | 15.5       | 18.8       |
| Length of caudal femur ..... | 14.5       | 18.6       |

One male and two females from the type locality have also been examined. The months represented are April and May.

**STAURORHECTUS BREVIPENNIS**, new species.

*Type*.—Male; Corumbá, Matto Grosso. Brazil (highland). March. (H. H. Smith.) [U.S.N.M., No. 9488.]

This species differs from the preceding in the smaller size, abbreviated tegmina, aborted wings, the more compressed fastigium and pronotum, and the shorter subgenital plate.

Size small; form moderately slender. Head with the occiput slightly ascending and arched, not exceeding the pronotum in length; fastigium acute with the apex blunt; in length less than the space between the eyes, moderately excavated; lateral foveolæ lateral in position, moderately impressed and without definite form; face moderately retreating, with the dorsal section vertical and narrowly rounded into the dorsum of the fastigium; frontal costa with the margins subparallel to the ocellus and very gradually diverging thence to the clypeus, slightly expanded between the antennæ, moderately sulcate dorsad, the ventral section excavate from margin to margin, but not sulcate; eyes ovoid, nearly twice the length of the infra-ocular sulcus; antennæ about twice the length of the head and pronotum together, depressed but not expanded proximad, rounded distad. Pronotum half again as long as the caudal dorsal width; cephalic margin arcuate with a slight median truncation, caudal margin slightly rotundato-angulate, a very faint trace of constricted lateral carinæ present; median carina very distinct,

<sup>a</sup>Proc. Acad. Nat. Sci. Phila., 1906.

intersected but once; prozona twice the length of the metazona, the latter distinctly rugoso-punctate; lateral lobes slightly longer than deep, caudal margin with an arcuate emargination, ventral margin with the caudal half obliquely descending, the cephalic half roundly emarginate. Interspace between the mesosternal lobes subquadrate, very slightly broader than long; metasternum with the lobes sub-attingent. Tegmina about half again as long as the head and pronotum together, falling considerably short of the apex of the abdomen, inflated; costal margin strongly arcuate in the distal half, sutural margin straight, apical margin acute-angulate with the apex rounded; marginal field quite narrow and with practically no dilation, intercalary vein strong, arcuate, immediate apex with subquadrate areas, anal field subequal in width for almost the entire length. Wings extremely short. Abdomen very slightly compressed; supra-anal plate subtrigonal, slightly longer than the proximal width; cerci styli-form, slender, slightly exceeding the apex of the supra-anal plate; subgenital plate conical, moderately produced, the apex blunt when viewed laterad, the dorsal margin compressed and carinate distad. Cephalic and median limbs rather slender, of medium size. Caudal femora nearly equal to the body in length, moderately expanded proximad, the pagina regularly and distinctly sculptured, the genicular region with the lobes extending well below the level of the ventral surface; caudal tibiae slightly shorter than the femora, slightly sinuate, lateral margins bearing nine or ten spines, the entire tibiae and tarsi supplied with long hair.

General color of the head and pronotum lemon yellow, a pair of black lines extending from the lateral borders of the fastigium, broadening caudad of the eye to half the depth of the same and extending to the caudal margin of the lateral lobe of the pronotum of which it occupies half the depth; dorsal margin sharply defined, ventral margin blending somewhat into the yellow color; eyes prouts brown; antennae tawny-olive proximad, blackish distad; face slightly washed with dull greenish, the infra-ocular suture marked with the same color. Pleura lemon-yellow with a narrow blackish dorsad bar. Tegmina pale tawny-olive. Abdomen dull gallstone yellow, the apex dull ochre yellow. Cephalic and median limbs oil green; caudal femora ochraceous, with the genicular region black and a very distinct pre-genicular annulus of gamboge yellow; caudal tibiae with the genicular region black, then clear malachite green blending into olive-green, with the distal portion paler than the median, spines with black; tarsi near pale chromium green.

*Measurements.*

|                             | mm.  |
|-----------------------------|------|
| Length of body .....        | 18.0 |
| Length of pronotum .....    | 3.5  |
| Length of tegmina .....     | 8.5  |
| Length of caudal femur..... | 12.0 |

An additional paratype male has also been examined. Aside from the fact that the antennæ are somewhat darker it does not differ from the type.

**BORELLIA, new genus.**

Allied to *Staurorhectus* Giglio-Tos, but differing in the head, which is not elevated, and with the face much less retreating, the distinct lateral foveolæ and carinæ of the angle of the fastigium and frontal costa, the slenderer and shorter antennæ, the more robust caudal femora, the shorter and thicker male cerci and the shorter and less produced male subgenital plate.

*Type*.—*Borellia carinata*, new species.

I take pleasure in dedicating this genus to Dr. Alfredo Borelli, of Turin, Italy, who has contributed greatly to our knowledge of South American Orthoptera by careful field work in the Gran Chaco region, furnishing the basis for Doctor Giglio-Tos's exhaustive papers on the Orthoptera of northern Argentina, Paraguay, and southern Bolivia.

**BORELLIA CARINATA, new species.**

*Types*.—Male and female; Chapada, Matto Grosso, Brazil. June. (H. H. Smith.) [U.S.N.M. No. 9486.]

Size small; form moderately robust; surface glabrous. Head slightly longer than the pronotum, the occiput very gently arcuate but not distinctly elevated; fastigium slightly declivent, the angle rectangulate (male) or distinctly obtuse-angulate, the extension beyond the interocular region being slightly (male) or very considerably (female) less than the width of the latter, dorsum of the fastigium moderately excavated; lateral foveolæ dorsad, distinctly impressed with the margins well raised and complete, oblong in shape, the length slightly more than twice the width; face moderately retreating, the dorsal section rounded, more so in the female than in the male, which is also the case with the angle of the face, the male having it more marked and less rounded than in the female; frontal costa acute dorsad, regularly expanding ventrad and reaching the clypus, very slightly constricted at the ocellus, distinctly but not deeply sulcate in both sexes; eyes subovoid, slightly more acute and slenderer in the male than in the female, very distinctly longer than the infra-ocular sulcus in both sexes; antennæ but very slightly exceeding the head and pronotum in length, slightly depressed proximad. Pronotum gently rounded

dorsad; cephalic margin very gently arcuate, caudal margin obtuse-angulate in both sexes, distinct lateral shoulders present on the metazona, rounded on the prozona; prozona and metazona subequal in length, the metazona regularly but not very deeply punctate; median carina cut only by the principal sulcus, traces of constricted lateral carinae present except mesad, and much more distinct in the female than in the male; lateral lobes very slightly longer than deep, the caudal margin slightly sinuate, the ventral with an irregular median obtuse angle. Interspace between the mesosternal lobes very slightly longitudinal in the male, very slightly transverse in the female; metasternal lobes subattingent in the male, approximate but very distinctly separate in the female. Tegmina considerably exceeding the apex of the abdomen, and slightly exceeding the tips of the femora; marginal field of the male distinctly but not greatly dilated, straight in the female, a slight proximal lobe present in both sexes; a distinct but sinuate intercalary vein present, the sinuate character being due to the very numerous short transverse nervures extending from the median and ulnar vein and in this way slightly diverting the vein from a direct course; ulnar area broad in the male, with several straight cross veins but no longitudinal vein, ulnar area narrow in the female and with a distinct longitudinal dividing vein; anal field irregularly reticulate in both sexes. Wings with the greatest width contained about twice in the length. Abdomen slightly compressed; supra-anal plate subobovate in shape, the apex blunt, surface without sulci except grooves paralleling the lateral and apical margins; cerci rather short, styliform, acute, very slightly longer than the supra-anal plate; subgenital plate somewhat inflated, bullate, the apex a slight, blunt tubercle. Cephalic and median limbs short, distinctly inflated in the male; caudal femora robust, moderately inflated, and regularly tapering to the narrowest section which is immediately pregenicular, pagina distinctly and regularly sculptured; caudal tibiae distinctly shorter than the femora, lateral margins armed with ten spines, internal spurs subequal; tarsi provided with large arolia.

General color burnt umber, the male with a touch of olive and without distinct maculations except a series of weak brownish spots on the ulnar area of the tegmina, which are hyaline suffused with the general color, and the dull brownish tips of the otherwise hyaline wings. The female is marked on the dorsum of the head and pronotum with a broad bar of apple green extending back from the vertex, while the pronotum and head bear more or less distinct longitudinal lateral touches of several shades of brown, and the spots on the tegmina are distinct, subquadrate, and blackish, but more distad than in the male. Caudal femora with the ventral surface ochraceous, the lateral faces touched with dull greenish and the genicular region blackish; caudal tibiae ochraceous-rufous, dull buff distad, the spines and spurs tipped with black; tarsi buffy.

## Measurements.

|                              | Male. | Female. |
|------------------------------|-------|---------|
|                              | mm.   | mm.     |
| Length of body .....         | 18.0  | 21.3    |
| Length of pronotum .....     | 3.5   | 4.3     |
| Length of tegmen .....       | 14.5  | 17.5    |
| Length of caudal femur ..... | 10.5  | 12.5    |

Three paratypic females taken in April and June have also been examined. No important difference between these and the type has been noticed. Several of the specimens have one or both of the caudal femora with ten spines on the lateral margins, while the intensity of the dorsal green bar is subject to variation. The paratypic specimens have the lateral aspects of the head paler and greenish instead of dark as in the type, leaving a distinct bar extending from the dorsum of the eye back to and over the dorsum of the pronotum.

STEREOTETTIX,<sup>a</sup> new genus.

This genus is closer related to *Borellia* Rehn, than any other genus of the group. From this it differs in the position of the lateral foveolæ, the presence of distinct parallel lateral carinæ on the pronotum, in the very narrow discoidal field of the tegmen, in the much more transverse interspace between the mesosternal lobes and the more elongate and strongly sulcate supra-anal plate of the male.

Superficially, this genus much resembles *Euplectrotettix* Bruner, a member of the Scyllini.

*Type*.—*Stereotettix paralogistes*, new species.

STEREOTETTIX PARALOGISTES,<sup>b</sup> new species.

*Types*.—Male and female; Chapada, Matto Grosso, Brazil. June. (H. H. Smith.) [U. S. Nat. Mus. No. 9490.]

Size very small; form moderately robust. Head slightly shorter than the pronotum; occiput gently arcuate, in the female a little more elevated dorsad of the level of the pronotum than in the male; fastigium extending beyond the eyes a distinct slightly or considerably less than the narrowest portion of the interocular region, the angle rectangulate in the male, subrectangulate in the female, the dorsum with an apical crescentic depression which leaves the margins in relief; lateral foveolæ ventrad of the fastigial margin and not visible from the dorsum, except the sections toward the frontal costa, elongate lanceolate, very deeply impressed; angle of the face considerably retreating, the apex truncate, forming a right angle with the fastigium; frontal costa rather acute dorsad, regularly expanding

<sup>a</sup> Στερεός stable, τεττιξ, grasshopper.

<sup>b</sup> Παραλογιστής, one who deceives by false calculation.

from the ocellus to the clypeus, distinctly but not deeply sulcate dorsad, impressed ventrad, this becoming less apparently toward the clypeus; eyes moderately prominent in the male, less so in the female, reniform ovate in outline, very considerably or slightly longer than the infra-ocular sulcus; antennæ considerably (male) or slightly (female) longer than the head and pronotum together, depressed and very slightly expanded proximad. Pronotum moderately deplanate dorsad; cephalic margin very slightly arcuate, caudal margin obtuse-angulate; prozona distinctly but not very considerably longer than the metazona, the latter thickly but not very deeply punctate; median carina distinct, cut only by the principal sulcus; lateral carinæ distinct, nearly parallel, with a very slight constriction from the first to third sulci in the male, and in the female apparently with a very slight divergence through the entire length, all three transverse sulci intersecting these carinæ; lateral lobes about as deep as the dorsal length of the lobe, ventral margin rounded mesad. Interspace between the mesosternal lobes distinctly transverse in both sexes; metasternal lobes attingent (male) or subattingent (female). Tegmina falling slightly short of the apex of the abdomen and very considerably short of the tips of the femora in the male, or exceeding the abdomen and equaling the femora in the female; marginal field expanded in both sexes, but stronger in the male than in the female; a broken or sinuate intercalary vein present in both sexes, but more distinct and continuous in the female than in the male; apex rounded, sutural margins nearly straight, wings reaching to the tips of the tegmina when in repose. Abdomen considerably compressed; supra-anal arched, elongate trigonal in shape with a longitudinal median depression; cerci rather slender styliform, reaching to the apex of the supra-anal plate; subgenital plate conic, the apex bluntly tuberculate, and extending very little beyond the supra-anal plate. Cephalic and median limbs of medium size, slender; caudal femora moderately robust, pagina distinctly but rather shallowly sculptured, the genicular region slightly inflated; caudal tibiæ distinctly but not considerably shorter than the femora, armed with 8 spines on the lateral margins; internal spurs unequal but the difference is not as great as seen in *Scyllina* and allied genera; arolia of the caudal tarsi of medium size, trigonal.

General color wood-brown, touched dorsad with fawn, a distinct post-ocular bar extending caudad to the caudal margin of the lateral lobes, rather irregular and broken on the lateral lobes, clove-brown in color; face spotted with bister; antennæ dark distad; eyes raw umber; tegmina with the series of faint dark subquadrate spots on the marginal field. Cephalic and median limbs more or less completely and regularly annulate with clove-brown, the annuli of the femora weaker than the tibial and tarsal ones. Caudal femora mesad on the dorso-lateral

faces with a trigonal velvety clove-brown spot; lateral faces ivory white; caudal tibiae very faint greenish, the spines tipped with black.

*Measurements.*

|                              | Male. | Female. |
|------------------------------|-------|---------|
|                              | mm.   | mm.     |
| Length of body .....         | 12.0  | 16.0    |
| Length of pronotum .....     | 2.3   | 3.0     |
| Length of tegmen .....       | 7.2   | 11.3    |
| Length of caudal femur ..... | 7.2   | 9.5     |

A paratype series of one male and two females, taken in June and September, have also been examined. Aside from the fact that the fastigium is slightly broader in these females than in the type, no character at variance with those of the types are noticed.

**TRISTIRA Brunner.**

1900. *Tristira* BRUNNER, COMUN. Museo Nac., Buenos Aires, I, No. 7, p. 235, fig.

*Type*.—*T. bergi* Brunner.

This very peculiar genus is considered by Brunner to be related to *Stauronotus* (*Doclostaurus*), but the general appearance and structure is so different and with so many peculiarities that the type is probably worthy of separation as a group *Tristiri*. This genus in many respects resembles *Closteridea* Scudder,<sup>a</sup> from Chatham Island, Galapagos, and it is quite likely they are closely related.

**TRISTIRA BERGI Brunner.**

1900. *Tristira bergi* BRUNNER, COMUN. Museo Nac., Buenos Aires, I, No. 7, p. 236, fig. [Filaret, Tierra del Fuego, Argentina.]

Gregory Bay, Straits of Magellan. (U. S. Fish Commission.) [U.S.N.M.] One male, four females.

In all the specimens but one the lateral abdominal carinae are marked with blackish, and in one female the median is the only one of the five not marked.<sup>b</sup>

**EUPLECTROTETTIX Bruner.**

**EUPLECTROTETTIX SCHULZI Bruner.**

1900. *Euplectrotettix schulzi* BRUNER, Acc. Gen. Spec. Locusts Argent., p. 41. [Vicinity of Cordoba, Argentina.]

Cordoba, Argentina. [U.S.N.M.] One male, one female.

In these individuals the three femoral dark bars which are moder-

<sup>a</sup> Bull. Mus. Comp. Zool., XXV, No. 1, p. 9, pl. 1, figs. 4-5.

<sup>b</sup> Brunner's description says: "Abdomen compressum, tricarinatum," while one of the specimens in his figure and the material in hand show five carinae, one median and two lateral pairs.

ately distinct on the dorsal surface are practically obsolete on the external face, the dorso-lateral region being suffused with a longitudinal blackish-brown bar.

### SCYLLINA Stål.

#### SCYLLINA UNIFORMIS, new species.

*Type*.—Female; Chapada, Matto Grosso, Brazil. April. (H. H. Smith.) [U.S.N.M. No. 9482.]

A peculiar species in some respects resembling *Boöpedon*, the weak and but moderately bowed lateral carinæ of the pronotum and the rather uniform coloration being distinctive.

Size medium; form robust, moderately but distinctly compressed. Head with the fastigium subrectangulate; depressed area crescentic cephalad and becoming indistinct caudad, interspace between the eyes slightly less than twice the width of the dorsal portion of the frontal costa; lateral foveolæ indistinct, impresso-punctate; frontal costa tumid, subequal, slightly constricted dorsad, lateral facial carinæ distinctly diverging ventrad; fastigium rounding into the frontal costa when viewed laterad; no distinct angle present; eyes acute reniform, slightly longer than the infra-ocular portion of the genæ; antennæ less than twice the length of the head, depressed except distad. Pronotum but little longer than greatest width; cephalic margin very broadly obtuse-angulate, caudal margin obtuse-angulate; median carina distinct, somewhat elevated, lateral carina very weak, marked more by callosities than true carinal ridges, moderately constricted, obsolete mesad; transverse sulcus bisecting the median carina very slightly in advance of the middle; lateral lobes very much deeper than long, ventral margin obtuse-angulate. Tegmina slightly exceeding the tips of the caudal femora; costal margin arcuate, with a slight basal expansion; apical margin obliquely rotundato-truncate; postradial area irregularly areolate and without a distinct intercalary vein. Wings large, costal margin distinctly arcuate distad. Cephalic and median limbs slender. Caudal femora robust, evenly and regularly but distinctly constricted in the pregenicular region, the proximal half considerably inflated, external pagina well marked; caudal tibiæ armed laterad with ten spines, longer internal calcar very slightly more than twice the length of the shorter.

General color between liver-brown and chestnut. Head suffused slightly with hoary; eyes tawny-olive; antennæ buff. Pronotum deep liver-brown, unicolorous. Tegmina very obscurely blotched with quadrate spots, between which the tegmen is hyaline, except proximad, where it is more coriaceous. Wings hyaline, with a very slight greenish-yellow suffusion proximad, apex slightly suffused. Limbs vinaceous-cinnamon and liver-brown; caudal femora with very obscure

dorsal bars, genicular arches blackish, carinæ of the lateral face beaded with blackish, ventral sulcus poppy-red; caudal tibiæ orange-vermilion, slightly speckled with brownish on the latero-proximal portion; caudal tarsi near poppy-red dorsad, very dull magenta ventrad.

*Measurements.*

|                              |             |
|------------------------------|-------------|
| Length of body.....          | mm.<br>34.0 |
| Length of pronotum .....     | 7.0         |
| Length of tegmen.....        | 30.5        |
| Length of caudal femur ..... | 22.5        |

A paratypic female was also examined (August). The color of this specimen differs from the type in that it is more brownish, and the caudal femora are distinctly barred dorsad.

**SCYLLINA BRUNNERI** (Giglio-Tos).

1895. *Pseudotaaronotus brunneri* GIGLIO-TOS, Zool. Jahrb., Abth. Syst., VIII, p. 81A, [Paraguay.]

Chapada, Matto Grosso, Brazil. April, August, and September. (H. H. Smith.) [U.S.N.M.] Five males and two females.

This exceedingly variable species is represented by individuals of all the three color phases so well described by Giglio-Tos. Type "a," with distinctly marked median and lateral pronotal carinæ and contrasted coloration, is represented by two males; type "b," with the dorsal surface uniform, but with the pronotal cross moderately distinct and the caudal femora barred, is represented by two females; type "c," which is quite uniformly colored without dorsal cross, restricted tegminal maculations and incomplete femoral bars, is represented by three males.

This species has been recorded from Paraguay, Caiza, southern Bolivia, and Colon. The latter record, although made by the describer,<sup>a</sup> appears rather doubtful.

**SCYLLINA SUFFUSA**, new species.

*Type*.—Female; Chapada, Matto Grosso, Brazil. September. (H. H. Smith.) [Cat. No. 9483, U.S.N.M.]

Allied to *S. picta* and *conspersa* on one hand and *S. varipes* and *smithi* on the other. From *picta* it can be readily separated by the slender build, while *conspersa* has shorter tegmina, less constricted lateral pronotal carinæ, broader frontal costa, and less distinct lateral foveolæ. From *varipes* it can be distinguished by the more arcuate and less retreating face, the distinct lateral foveolæ, the more arcuate caudal margin of the pronotum, the somewhat less compressed body and slenderer limbs; from *smithi* it can be separated by the

<sup>a</sup>Boll. Musei di Zool. et Anat. Comp., Torino, XII, No. 301, p. 3, 1897.

rather broader body, the broader fastigium, the deeply excavated lateral foveolæ, the more angulate caudal margin of the pronotum, and the more rounded face.

Size, medium; form slender. Head with the fastigium rather broad, blunt rectangulate, depressed area crescentic, rather shallow, interspace between the eyes over half again as broad as the frontal costa at its narrowest (dorsal) part; lateral foveolæ elongate, narrow, deeply impressed; fastigium rounding moderately into the frontal costa when viewed laterally; frontal costa narrow dorsad, gradually but slightly expanding ventrad, biseriate punctate dorsad of the ocellus; supplementary facial carinæ precurrent, diverging ventrad; eyes subreniform, slightly longer than the infra-ocular portion of the genæ; antennæ slender, slightly depressed. Pronotum with the cephalic margin very slightly arcuate, caudal margin narrowly obtuse-angulate, nearly rectangulate; median carina distinct, cut slightly cephalad of the middle, lateral carinæ distinct cephalad and caudad, subobsolete mesad, distinctly and considerably constricted; lateral lobes over half again as deep as long, cephalic and ventral margins subparallel, ventral margin arcuate obtuse-angulate. Tegmina elongate, extending beyond the apex of the abdomen a distance slightly greater than the length of the pronotum; costal dilation slight; apex rotundato-truncate; post-radial area irregularly areolate proximad, biareolate distad, a crude intercalary vein present distad. Cephalic and median limbs slender. Caudal femora slender, proximal enlarged portion considerably inflated, the distal section evenly narrowed, pattern of the pagina regularly and distinctly impressed, genicular region slightly inflated; caudal tibiæ armed with ten spines laterad, longer internal spur with the apex sharply hooked, slightly more than twice the length of the shorter.

General colors cinnamon and clove brown. Head dark dorsad, with a slight and indistinct post-ocular line and a distinct but narrow infra-ocular line along the suture; eyes dark ferruginous; antennæ dark. Pronotum with the light lateral carinæ distinct, obscure mesad; lateral lobes with a heavy blotch, as usual in the genus, extending from the principal sulcus dorsad obliquely ventrad to the ventro-cephalic angle, caudal portion with several regular dark blotched. Tegmina regularly and subequally blotched, the blotches rather indistinct distad; anal area with small quadrate blotches thickly distributed. Limbs marked with both general colors; caudal femora strongly barred transversely dorsad, the bars extending obliquely proximad over the dorsal half of the lateral face, dorsal surface with the light areas touched with ferruginous, the light portion of the lateral face inclining toward bone-white, genicular region dark, ventral face very dark wine purple; caudal tibiæ ranging from very pale buff distad through poppy-red to purplish, the lateral faces blotched irregularly with brown, spines blackish nearly their whole length, spurs with the tips and caudal margins

blackish; caudal tarsi with the two proximal joints dull purplish with the tips and the third joint ochraceous.

*Measurements.*

|                             | mm.  |
|-----------------------------|------|
| Length of body.....         | 33.0 |
| Length of pronotum.....     | 6.2  |
| Length of tegmen.....       | 32.0 |
| Length of caudal femur..... | 22.0 |

The type is unique.

**SCYLLINA SMITHI, new species.**

*Types*.—Male and female; Chapada, Matto Grosso, Brazil. May (male) and September (female). (H. H. Smith.) [Cat. No. 9484, U.S.N.M.]

Allied to *S. varipes* Bruner but slenderer and differing in the longer tegmina and caudal limbs, the fuller eyes, the subequal lateral lobes and the more constricted lateral carinæ of the pronotum as well as the longer, straighter, and more hooked major tibial spur.

Size medium; form slender. Head slightly ascending; fastigium rounded rectangulate, shallow, crescentic, interspace between the eyes slightly greater than the dorsal width of the frontal costa, lateral foveolæ oblong, impresso-punctate; angle of the fastigium and frontal costa viewed laterad narrowly rounded in the male, moderately rounded in the female, face distinctly and strongly retreating; frontal costa subequal, slightly constricted dorsad and faintly biseriate punctate; supplementary facial carinæ distinct, diverging ventrad; eyes subtrigonal, reniform, about half as long again as broad, pointed dorsad, distinctly longer than the infra-ocular portion of the genæ; antennæ slightly depressed proximad. Pronotum with the cephalic margin slightly arcuate, caudal margin obtuse-angulate, the angle broader and more rounded in the female than in the male, lateral carinæ distinct cephalad and caudad, obsolete mesad and strongly constricted; median carina distinct, regular, cut very little cephalad of the middle; lateral lobes about a third again as deep as long, cephalic and caudal margins straight, subparallel, ventral margin obtuse-angulate, more rounded in the male than in the female. Tegmina elongate, extending considerably beyond the apex of the abdomen and exceeding the tips of the caudal femora by slightly less than the length of the pronotum, costal dilation slight, tips rotundato-truncate; postradial area irregularly areolate proximad, roughly biareolate distad, no distinct intercalary vein present in the female, distinct in the male. Caudal femora elongate, slender, distal inflation considerable, regular, distal third quite slender, pattern of the pagina distinct; caudal tibiæ with ten to twelve lateral spines, longer internal spur over twice the length of the shorter, rather straight with the tip hooked.

General color seal brown and ochraceous, a distinct subequal median line extending from the fastigium to the extremity of the anal area of the tegmina. Head dark above, except for the median line, no distinct postocular bar aside from the dorsal suffusion, a distinct infraocular dark sutural line present in the male, unmarked in the female; eyes ferruginous; antennæ ochraceous buff, darkened distad. Pronotum with the lateral carinæ distinctly marked with the lighter color, weak mesad; lateral lobes with the two base colors intermingled, the usual oblique bar broken in the male, distinct in the female. Tegmina with rather regular transverse bars, heavier and wider distad than proximad, the anal area, except the median line, and angle very dark and hardly maculate in the female. Caudal femora distinctly barred dorsad and obliquely proximad on the lateral faces with darker, the pregenicular dark bar wide, ventro-lateral carina beaded with the dark color, very closely beaded in the male, pregenicular light annulus complete, genicular region dark, ventro-lateral face very dark heliotrope purple, ventro-internal face and sulcus maroon purple; caudal tibiæ saturn red proximad blending into dull carmine distad, blotched with brown laterad, spines blackish at least half their length, spurs blackish distad and on the caudal margins.

Measurements.

|                              | Male. | Female. |
|------------------------------|-------|---------|
|                              | mm.   | mm.     |
| Length of body .....         | 26.5  | 31.2    |
| Length of pronotum .....     | 4.8   | 5.8     |
| Length of tegmen .....       | 24.3  | 29.5    |
| Length of caudal femur ..... | 17.5  | 20.5    |

Three paratypic males have also been studied (May and June). These present a great amount of color variation, chiefly, however, in the intensity. The suffusion of the dorsum of the head is limited in some and distinct postocular bars present; the median line is obsolete on the anal area of the tegmina in several, and in these specimens the angle of the tegmina bears a pale line; while several specimens have the lateral lobes with large strongly contrasted blotches of color instead of small irregularly distributed spots.

**SCYLLINA SCHISTOCERCOIDES**, new species.

*Type*.—Female; Chapada, Matto Grosso, Brazil. (H. H. Smith.) [Cat. No. 9485, U.S.N.M.]

Closely allied to *S. borrellii* Giglio-Tos, from the Rio Apa region, Paraguay, but much smaller and with other differences, such as the distinct blackish blotches on the lateral lobes of the pronotum.

Size rather large; form rather slender and superficially resembling species of the genus *Schistocerca*. Head somewhat ascending; fas-

fastigium rounded rectangulate, slightly impressed in the form of a crescent, interspace between the eyes slightly more than half again as broad as the dorsal width of the frontal costa; lateral foveolæ rather weak, punctate; angle of the fastigium and the frontal costa narrowly rounded, the face roundly and moderately retreating; frontal costa tumid, strongly constricted dorsad, regularly but slightly expanding ventrad of the inter-antennal region, biseriate punctate dorsad of the ocellus; eyes subreniform, rather sharply angulate dorsad, about equal in length to the infra-ocular portion of the genæ; antennæ slightly depressed proximad. Pronotum with the cephalic margin slightly arcuate, caudal margin very obtusely angulate, the angle rounded, lateral carinæ moderately distinct, obsolete mesad, moderately constricted, the carinæ regularly and moderately diverging caudad; median carina distinct, low, cut slightly in advance of the middle; lateral lobes of the pronotum about a third again as deep as long, the cephalic and caudal margins subparallel, ventral margin obtuse-angulate, slightly emarginate cephalad. Tegmina moderately elongate, exceeding the apex of the abdomen by little less than the combined length of the head and pronotum, exceeding the tips of the caudal femora by nearly the length of the pronotum; costal dilation moderate; tips rotundato-truncate; postradial area roughly biareolate distad, no distinct intercalary vein present. Caudal femora slender, proximal portion moderately inflated, distal portion regularly narrowed, pattern of the pagina distinctly and sharply sculptured; caudal tibiæ with ten lateral spines present, longer internal spurs slightly more than twice the length of the shorter, comparatively straight except for the recurved and hooked tips.

General colors prouts brown and ochraceous, a median pale line extending from the fastigium to the tips of the anal area of the tegmina. Head with the median line broad, flanked laterad by large blotches of darker, which replace the postocular bars and extend around the caudal margin of the eye to the infra-ocular sulcus, which is broadly infusate to the angle of the mandible; eyes cinnamon; antennæ pale ochraceous, infusate distad. Pronotum dark above, excepting the median line, with the lateral carinæ very faintly marked with lighter; lateral lobes slightly suffused dorsad, the usual oblique blotch very deep in color and large in size. Tegmina with the suffusions rather weak, the dark areas wide and unbroken except distad, costal area hardly suffused. Caudal femora pale, with very slight indications of transverse bars dorsad, lateral face dark brown immediately along the ventro-lateral carina, otherwise unmarked; genicular region brownish; proximal two-thirds of the ventral surface very dark verditer blue; caudal tibiæ with the proximal two-thirds orange, distal third very dark verditer blue, spines two-thirds blackish; tarsi washed above with the blue of the tibiæ.

## Measurements.

|                             | mm.  |
|-----------------------------|------|
| Length of body.....         | 38.0 |
| Length of pronotum.....     | 7.2  |
| Length of tegmen.....       | 39.0 |
| Length of caudal femur..... | 24.5 |

The type is unique. The species superficially bears considerable resemblance to species of the genus *Schistocerca*, a fact noted by Giglio-Tos in his description of the closely allied *S. borellii*.

## STIRAPLEURA Scudder.

## STIRAPLEURA BRUNNEA, new species.

*Types*.—Male and female; Chapada, Matto Grosso, Brazil. August (female) and September (male). (H. H. Smith.) [U.S.N.M., No. 9489.]

Allied to *S. pallida* and *obscura* Bruner, but differing from the former in the larger head, broader fastigium, constricted pronotum, and more uniform coloration. From *S. obscura* it differs in the larger size, shallower and narrower fastigium, and shorter but more inflated caudal femora.

Size medium; form moderately robust. Head with the fastigium broad, slightly acute-angulate in the male, obtuse-angulate in the female, rounded, depressed area crescentic in the female, semicircular in the male; interspace between the eyes very little narrower than the greatest width of the fastigium and but slightly more than half again as wide as the dorsal portion of the frontal costa; lateral foveolæ slightly longer than wide, impresso-punctate; angle of the fastigium and frontal costa when viewed laterad very slightly rounded; face distinctly retreating, slightly arcuate; frontal costa tumid, slightly but gradually expanding ventrad, not sulcate, irregularly punctate; supplementary facial carinæ distinct, strongly divergent; eyes ovoid, distinctly (male) or slightly (female) longer than the infra-ocular portion of the genæ; antennæ slightly depressed proximad. Pronotum with the cephalic margin slightly arcuate, caudal margin obtuse-angulate, the angle very narrowly rounded; median carina distinct, cut in the middle; lateral carinæ distinct cephalad and caudad, obsolete mesad, moderately constricted; lateral lobes about half again as deep as long, cephalic and caudal margins parallel, ventral margin rounded, rotundato-emarginate cephalad. Tegmina extending beyond the tips of the caudal femora by a distance slightly less than the length of the pronotum; veins coarse; tips rotundate; costal dilation slight; postradial area irregularly areolate with a crude biareolate arrangement distad. Caudal femora considerably inflated proximad, constricted distad, the constriction of little

length, pattern of the pagina distinct, sharply cut; caudal femora with nine spines on the lateral margins; shorter tibial spurs about two-thirds the length of the longer, evenly curved.

General color dull cinnamon, washed irregularly with seal brown. Head without postocular bar; antennal fossa of both sexes and the infra-ocular sulcus marked with blackish; eyes ferruginous. Pronotum with a very faint median bar in the female margined laterad by faint blotches of darker color; lateral carinæ faintly marked with lighter; lateral lobes unicolorous in the male, marked obliquely with a blackish bar in the female, the bar extending from the dorso-caudal to the ventro-cephalic angles. Tegmina obscurely sprinkled with small dark spots, the veins distinctly marked with darker in the female. Caudal femora light with the usual triangular spot on the dorsal surface distinct in the male, weak in the female, the lateral face in the female with a longitudinal dark line following the center of the pattern of the pagina, ventral surface pale, unicolorous; caudal tibiae dull yellowish, blackish proximad with a pale pregenicular annulus, spines blackish for about two-thirds the length.

*Measurements.*

|                              | Male. | Female. |
|------------------------------|-------|---------|
|                              | mm.   | mm.     |
| Length of body .....         | 15.0  | 22.0    |
| Length of pronotum .....     | 8.5   | 4.2     |
| Length of tegmen .....       | 14.1  | 17.5    |
| Length of caudal femur ..... | 10.0  | 12.0    |

A paratypic series of one male and two females have been studied, in addition to the types, taken in June and July. These are very similar to the male type in coloration, except that the male has the dorsum of the head and pronotum dark and the females have the dorsum of the metazona dark, a tendency toward which is noticed in the male type. The lined veins of the tegmina are distinct only in the female type. The color of the caudal tibiae is also subject to considerable variation, being livid in some specimens.



## DESCRIPTIONS OF TWO NEW NAIADS.

By PAUL BARTSCH,  
*Assistant Curator, Division of Mollusks.*

Among the Unionidæ received by the United States National Museum in the past two years are two undescribed species, which are here diagnosed.

### NEPHRONAIAS FLUCKI, new species.

Plates XXVII-XXIX.

*Description.*—Shell elliptical, moderately inflated, attenuated posterioro-ventrally; sloping gently and evenly dorsally from a line extending from the umbones to the posterior ventral angle. Dorsal line evenly arcuate, curving a little more abruptly anteriorly than at the posterior end; ventral margin almost straight or slightly concave. In some, presumably the females, the shell is somewhat drawn out ventrally at the posterior margin, and in such the ventral outline necessarily appears more concave. Surface marked by numerous very strong concentric lines of growth and crinkly radiating rays which are most pronounced on the anterior end and gradually fade out from the middle of the shell posteriorly. Periostracum shining, dark brown at the umbones, fading gradually to greenish yellow at the edge. Umbonal cavity moderately deep. Pseudocardinal of the right valve strong, triangular, deeply notched (almost bifid by the deep vertical  $\wedge$ -shaped notch in old specimens), with numerous fine secondary notchings. Pseudocardinals of the right valve rather slender, finely notched, inclosing a  $\wedge$ -shaped cusp between them, which corresponds to the  $\wedge$ -shaped notch in the other valve. Laterals narrow, slightly arcuate and obliquely ridged. Dorsal muscle scars feeble. Nacre bluish white at the margin, shading to livid olive dorsally.

There are four specimens of this species before me, all with more or less eroded umbones. They measure:

| Length.    | Height.    | Diameter.  |
|------------|------------|------------|
| <i>mm.</i> | <i>mm.</i> | <i>mm.</i> |
| 53.7       | 32.7       | 22.5       |
| 51.2       | 32         | 21.7       |
| a 64       | 26.7       | 17.6       |
| 40         | 23.7       | 13.6       |

a Type.

*N. flucki* can be readily separated from the other *Nephronaias* of the region by its rugose sculpture, in which respect it resembles *N. dysoni* Lea, from Costa Rica, and by its wavy radiating lines and the dark nacre.

*Type*.—Cat. No. 106121 U.S.N.M. The specimens were collected by the Rev. W. H. Fluck at Wounta River, northwest of Kukallaya, Nicaragua.

DIPLODON HUAPENSIS, new species.

Plates XXVII-XXIX.

*Description*.—Shell thin, elongate, elliptical, drawn out posterior-ventrally into a blunt beak, compressed dorsally, from a line extending from the umbones to the postero-dorsal margin of the beak and somewhat pinched in its subcentral ventral half. Dorsal margin slightly curved, its posterior third sloping regularly obliquely downward. Anterior margin abruptly curved, falling off a little more gradually toward the ventral than the dorsal edge. Posterior extremity evenly rounded. Ventral margin somewhat concave in the middle. Periostracum brown on the posterior dorsal portions of the shell, grading to wax yellow streaked with brown on the anterior ventral parts. Surface marked by numerous lines of growth, the stronger ones of which are usually darker colored than the general surface, and numerous fine, crinkly, radiating lines, which are best developed on the anterior half, and gradually diminished in prominence posteriorly. Beak cavities shallow. Pseudocardinals in the right valve two, narrow, weak, sublamellar, and very oblique, the dorsal one decidedly notched and stronger than the ventral, which is rugose. Left pseudocardinal narrow, slender, slight, notched, and cut into many fine tubercles. Right lateral only moderately curved, very slender, slightly roughened, more so on the inner than the outer edge. Left laterals thin, and lamellar, inner one larger and better developed than the dorsal, both with roughened edges. Nacre bluish, with many spots of livid olive, which are more numerous and extensive in the dorsal part of the shell than ventrally. Posterior part iridescent.

There are two specimens of this species in the U. S. National Museum, No. 186117. The shells measure: Type, length, 55 mm.; height, 25.9 mm.; diameter, 14.5 mm.; the other—length, 57 mm.; height, 27.3 mm.; diameter, 16 mm.

*Description of soft parts*.—Animal pale flesh colored. Mantle thickened near the edge all the way around from the anterior to the posterior end; this thickening is cord-like and becomes decidedly strengthened in the syphonal regions. The mantle slopes from the cord to a thin edge, which is more or less marked by longitudinal, parallel ridges. The space between the cord and the edge is dark colored on the inside. Syphons completely separated, the space between them being about 2 mm. wide. Ventral syphon 7 mm. long, thick

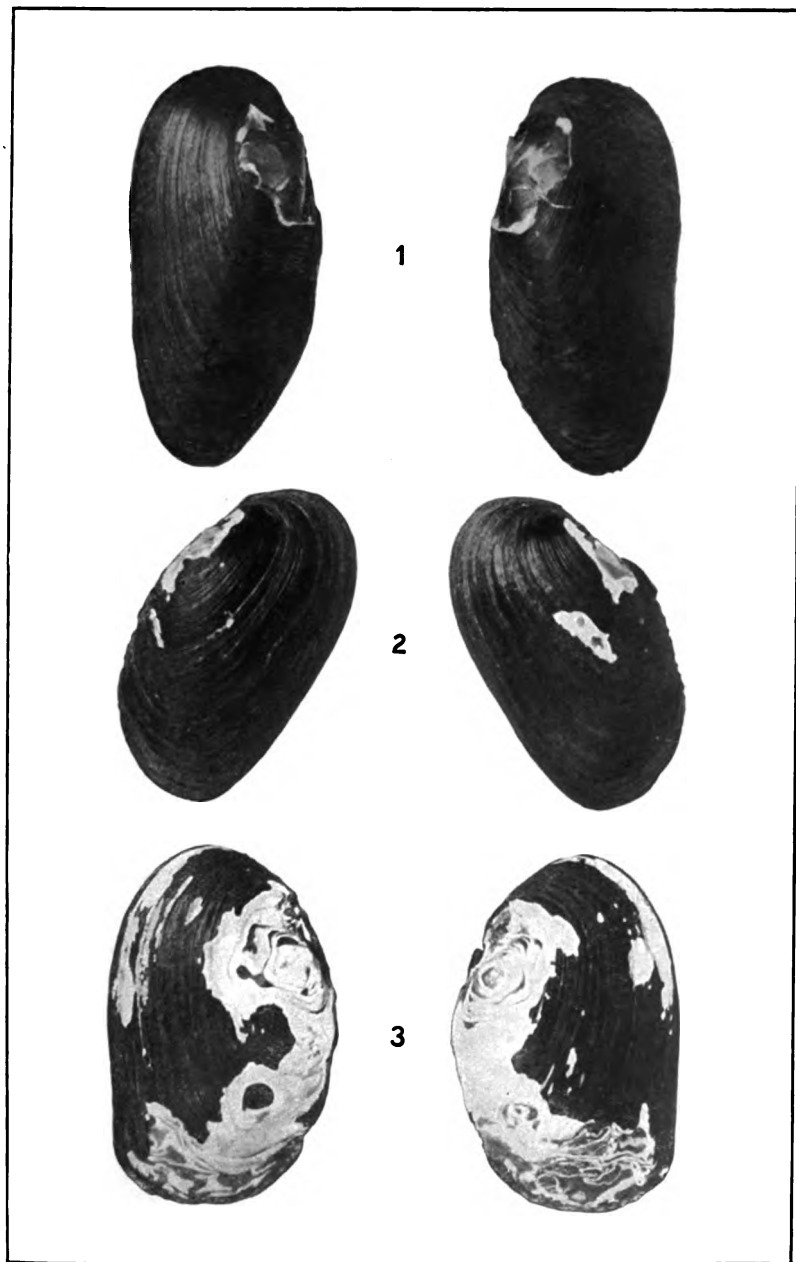
walled, and beset with several rows of long, thick, conical papillæ. Dorsal syphon 6 mm. long, moderately thick walled, and not papillose. Outer gills much smaller than inner, terminating somewhat posterior to the basal attachment of the inner gills; roughly they represent an isosceles triangle, the base of which constitutes the line of attachment; the anterior edge is a little less regular, not quite as straight as the posterior side, and falls off just a trifle more abruptly. The inner gills correspond at the posterior end with the outer gills in size, shape, and slope, but they extend forward in a slightly curved line, almost undiminished in width to the labial palpi, where they are suddenly deflected dorsally, their anterior margin being very short. Labial palpi small, with the free edge somewhat sinuous, agreeing with each other in shape and size, but the outer one is attached to the mantle in such a way that it probably presents only half the free surface on its outside that the inner presents on its inside. The space between them is equal. Foot and body of the animal small, the entire length of the body at the base of the gills being only 29 mm., while the entire length of the animal from the anterior mantle edge to the posterior mantle edge is 52.5 mm. The posterior half of the mantle is ash colored, deepest at the posterior edge, fading gradually anteriorly.

The shell in a general way recalls *Diplodon casæblancæ* Philippi and *Diplodon frenzellii* Ihering, but can readily be distinguished from them by its narrower outline.

This species is reported to be very abundant in a small lake on Victoria Island, in Lake Nahuel Huapé, Argentina, where the natives are said to roast and eat them.

One of the specimens has four latéral teeth, two in the right valve, instead of one; the ventral one of these, the extra one, is almost as strong as the dorsal member.

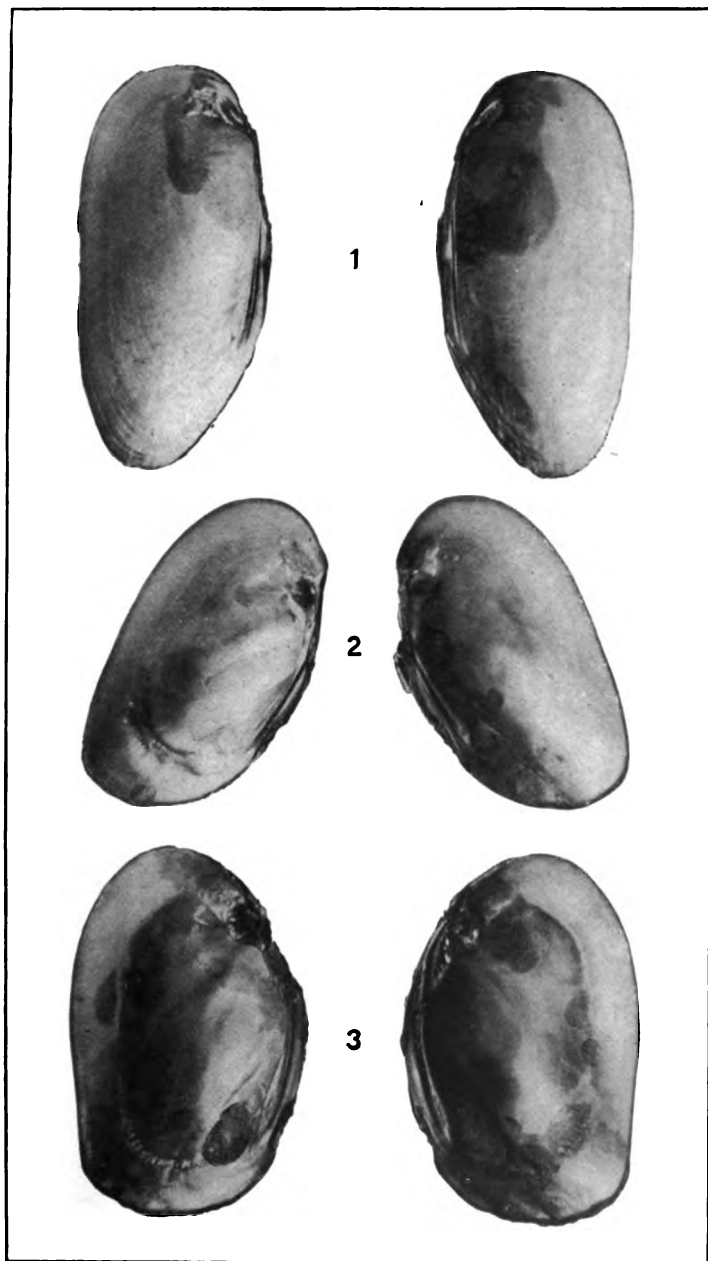




PEARLY FRESH-WATER MUSSELS.

FOR EXPLANATION OF PLATE SEE PAGES 393, 394.





PEARLY FRESH-WATER MUSSELS.

FOR EXPLANATION OF PLATE SEE PAGES 393, 394.





1



2



3

**PEARLY FRESH-WATER MUSSELS.**

FOR EXPLANATION OF PLATE SEE PAGES 393, 394.



# A SYNOPSIS OF THE STURGEONS (ACIPENSERIDÆ) OF JAPAN.

By DAVID STARR JORDAN and JOHN OTTERBEIN SNYDER,  
*Of Stanford University, California.*

Two species of sturgeon (*Acipenser*) are known to inhabit the waters of Japan. In addition to these, a few other species have been recorded from rivers of Manchuria and of China. These may be found to enter streams of Saghalin or of Hokkaido.

The following is an analysis of the species known in Japanese waters:

## Genus ACIPENSER Linnæus.

- a. Dorsal fin very long, of more than 60 rays; anal rays about 40; dorsal plates 11; lateral plates 32; skin between series of scales nearly smooth; anal below posterior part of dorsal; snout rather short ..... *kikuchii*
- aa. Dorsal fin moderate, of 35 to 40 rays; anal rays about 30; dorsal plates 7 or 8, lateral plates 34; skin between series of shields with small stellate plates; snout rather sharp ..... *mikadoi*

## ACIPENSER KIKUCHII Jordan and Snyder.

*Acipenser kikuchii* JORDAN and SNYDER, Journ. Coll. Sci. Tokyo, XV, 1901, p. 302, pl. xv, figs. 1, 2; Misaki, Sagami Bay.

Head,  $4\frac{1}{2}$  in length; depth, 7. Snout,  $2\frac{3}{4}$  in head. Dorsal plates, 11; lateral, 32; ventral, 11. Dorsal rays, III, 63; anal, III, 37. Head longitudinally concave above. Snout shortish, rather sharp. Dorsal plates large, rugose, without distinct spines; lateral plates each with a spine in front, those below smooth. A large rugose plate behind dorsal and behind anal. No bony plates on body except the five series, and a few small ones between the large anterior ones of dorsal series, the skin between the rows of plates soft and smooth. Opercle rugose; cheeks with fine stellate prickles. Height of dorsal,  $2\frac{1}{2}$  times in head; insertion of anal below posterior part of dorsal; pectoral,  $1\frac{1}{2}$  in head; upper lobe of caudal,  $1\frac{1}{2}$  times head.

Of this species but one specimen is known. This is a mounted example, 1.80 meters long, in the Museum of the Imperial University of Tokyo. It was taken in a net in the open sea off Misaki, in Sagami

Bay. It is distinguished from most other sturgeons by the very long dorsal fin.

(Named for Prof. Dairoku Kikuchi, late president of the Imperial University of Tokyo.)

**ACIPENSER MIKADOI Hilgendorf.**

**CHOZAME (CHIEF SHARK).**

*Acipenser mikadoi* HILGENDORF, Sitz. Naturf. Freunde Berlin, 1901, p. 98: Tokyo market, doubtless from Hokkaido.—JORDAN and SNYDER, Journ. Coll. Sci. Tokyo, 1901, p. 303: Ishikari R., Teshio, Mikawa.—SCHMIDT, Pisc. Mar. Orient, 1904, p. 284: Hakodate, etc.

Head,  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in length; depth,  $6\frac{1}{2}$  to 7. Snout, 2 to  $2\frac{1}{4}$  in head. Dorsal plates, 7 or 8; lateral,  $3\frac{1}{2}$ ; ventral, 9. Dorsal rays, IV, 31 to IV, 36; anal rays, III, 25 to III, 28.

Top of head, bony; snout, short, rather sharp; cheeks with rough plates; opercle, rugose. Sides above, between series of large plates, with smaller plates mostly stellate, 14 of these forming an irregular row below the dorsal series; plates, well keeled, with radiating striæ, rather than rugose; 4 to 6 plates behind dorsal; 2 to 4 behind anal.

Pectoral,  $\frac{1}{2}$  in head; height of dorsal,  $3\frac{1}{2}$ ; upper lobe of caudal,  $1\frac{1}{2}$  in head.

Described from three examples in the Imperial Museum of Tokyo, each about  $1\frac{1}{2}$  meters in length, the first from the Ishigari River, in Hokkaido, the others from streams in Teshio and Mikawa, all of these localities being in the island of Hokkaido. This is the common sturgeon of northern Japan, known as chozame or chief shark.

(Mikado, the emperor of Japan.)

# DESCRIPTIONS OF NEW GENERA AND SPECIES OF SOUTH AMERICAN GEOMETRID MOTHS.

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By WILLIAM WARREN,  
*of London, England.*

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The following species are described from the collection of Mr. William Schaus, and comprise the new forms contained among the specimens which he put in my hands for determination. A majority of the species are from the Guianas, but others are included from different parts of the neotropical region, Mexico, Cuba, and Brazil. The types are in the U. S. National Museum.

## Family URANIIDÆ.

### Subfamily EPIPLEMINÆ.

#### Genus ANTIPLECTA Warren.

#### ANTIPLECTA CAESIA, new species.

*Forewing*.—Blackish slate-color; the lines darker; first angled outwards in middle, the outer outcurved above, indented on submedian fold, where it approaches inner line, then again outcurved, preceded throughout by blacker shading, which on inner margin forms a dark blotch between the two lines; a blackish line from below apex to below vein 4 on hind margin, with black spots between the veins; fringe concolorous.

*Hindwing*.—With the two lines black and curved, the space between them blacker, both plainer toward inner margin, the outer with a pale edge. Under side dark gray in forewing, whitish in hindwing.

Head, thorax and abdomen blackish; face black; vertex and antennal shaft snow-white; antennæ of male with thick clavate teeth.

*Expanse of wings*.—17 mm.

*Localities*.—Jalapa, Mexico, one male, one female; Orizaba, Mexico, one male.

Hindwing in both sexes minutely dentate at veins 7, 6, and 4; the fold beneath on inner margin of male hindwing with its tuft of hairs whitish.

*Type*.—Cat. No. 9144, U.S.N.M.

**ANTIPLECTA CINERASCENS, new species.**

*Forewing*.—Dingy cinereous with darker markings; in the male paler, slightly reddish tinged toward margin; inner line at one-third, projecting outward on median vein, outer line from two-thirds of costa, outwardly oblique to vein 6 then vertical to 2, sinuous below to three-fourths of inner margin; space between the lines dark fuscous; in the female the fascia so formed is broad and entire; in the male narrowed below middle and partially interrupted; a line of three or four black spots from costa before apex to below middle of hind margin and a submarginal more or less interrupted cloud, always marked on costa; fringe gray.

*Hindwing*.—With inner line angled outward on median; outer, well-curved, from just beyond middle of costa to inner margin above anal angle; the lines in both wings are dark brown edged slightly with pale; in the male the angle of inner line is filled in with redder gray; slight black marginal mark before fringe between veins 3 and 7.

Under side dark cinereous, slightly speckled, and paler in hindwing.

Vertex and base of antennæ whitish; thorax and abdomen dark gray; face and palpi blackish; tuft of hair from base of furrows in male pale ochreous.

*Expanse of wings*.—17 mm.

*Locality*.—Cayenne, French Guiana; 1 male, 2 females, January and February, 1904.

Hindwing of female minutely crenulate and toothed between veins 3 and 7; of male with an indentation between veins 4 and 3. The female is uniformly darker than the male. The species comes close to *A. pusilla* Warren, from Dominica.

*Type*.—Cat. No. 9145, U.S.N.M.

**ANTIPLECTA NIGRIPLETA, new species.**

*Forewing*.—Grayish flesh-color; the markings almost identical with those of the male of *A. cinerascens*; the base of wing remaining of the pale ground-color; the outer edge of fascia more plainly edged with paler.

*Hindwing*.—With the outer line less strongly curved, the basal area within it wholly blackish except along inner margin; the dark marks before fringe scarcely traceable.

Under side of forewing dull gray-brown with dark speckling; of hindwing ochreous flesh-color, without speckling.

Head, thorax, and abdomen like wings; the vertex not white; face blackish.

*Expanse of wings*.—16 mm.

*Locality*.—Jalapa, Mexico; 1 male.

Forewing more elongate than in *cinerascens*, the hind margin much more oblique; hindwing, even in the male, with the fringe slightly toothed; the indentation before the inner marginal furrow much deeper.

*Type*.—Cat. No. 9146, U.S.N.M.

**ANTIPLECTA TRIANGULARIS, new species.**

*Forewing*.—Pale stone-gray, slightly dusted with darker; the lines fine, blackish, inner angled outward in midwing, outer angled at veins 6 and 3, preceded sometimes by a blackish shading; the interval on inner margin generally dark, a dark submarginal cloud at costa and anal angle; a very fine line from costa before apex to below middle of hind margin, with fine dark marks on it; fringe gray with darker middle line and with the tips mottled darker.

*Hindwing*.—With the outer line well curved and preceded by blackish shading; inner line very faint; slight gray submarginal shades and very fine marginal line.

Under side pale gray, darker in forewing, with some dark dusting.

Thorax and abdomen pale gray; vertex and shaft of antennæ white; face black.

*Expanse of wings*.—16 mm.

*Locality*.—Orizaba, Mexico; 2 males, 2 females.

Hindwing of female shouldered at apex and toothed at veins 7, 6, and 4; of male indented before furrow, which below appears to be clothed with mealy yellowish scales.

Forewings, narrow, with oblique hind margin.

*Type*.—Cat. No. 9147, U.S.N.M.

**Genus CAPNOPHYLLA Warren.**

**CAPNOPHYLLA ALBICEPS, new species.**

*Forewing*.—Dark chocolate-brown; in the costal half of the wing with the pale ground-color showing as slight striæ between the brown ones; the two lines darker, especially on inner margin; the first strongly excurved in middle, the outer outcurved above middle and strongly insinuate on submedian fold, projecting bluntly at vein 6 and prominently again below vein 4; edged with ferruginous; a black line with paler edge from before apex to near anal angle, beyond which the margin is darker; fringe brown, with two darker lines.

*Hindwing*.—Brighter chocolate; inner line dark, waved, marked by some white scales above median and a bright, white dot on subcostal vein; outer line finely whitish, curved, beyond a deeper shade of brown, and followed by some whitish scales toward inner margin; a fine, dark marginal line; fringe brown; of inner margin whitish.

Under side dull gray-brown, with dark transverse speckling.

Thorax and abdomen brown; face black; vertex and antennæ snow-white.

*Expanse of wings*.—26 mm.

*Locality*.—São Paulo, southeast Brazil; 1 female.

Forewing with hind margin simple; hindwing with a long tooth at veins 4 and 7, and a short one at 6. Except in the forewing, the female is quite unlike the male.

*Type*.—Cat. No. 9148, U.S.N.M.

Genus CÆLUROTRICHA, new genus.

Differs from *Caelura* Warren in the male having the costal vein of hindwing above for half the length clothed with a bed of rough scales containing a tuft of long hair from base, the costal edge being slightly convex. In all other points it agrees with *Caelura*.

*Type*.—*Cælurotricha curvilinea*, new species.

CÆLUROTRICHA CURVILINEA, new species.

*Forewing*.—Bone-color, more or less discolored with dull gray striæ, which are denser and form dark spots along costa; a large dull gray round spot on discocellular; a fine curved outer line from two-thirds of costa, oblique inward from cell to inner margin at two-thirds; touching this line below subcostal vein is a round, pale fulvous spot with dark edges; a submarginal streak of gray striæ fringed with fulvous, and marked by a small dark spot above vein 6; extreme hind margin fulvous, edged with gray; fringe whitish, with a gray basal line running out to the tips at apex.

*Hindwing*.—With the line postmedian, running from veins 6 to 2, the area beyond it, except at apex, heavily striated with gray; some scattered striæ along inner margin to base; the tuft and bed of hairs fuscous-gray.

Under side of forewing straw-color; the cell spot a broad, bent, outer shade; the marginal line and some subapical striæ brown; hindwing with a few speckles along hind margin.

Head, thorax, and abdomen like wings; face and palpi black-brown.

*Expanse of wings*.—26 mm.

*Locality*.—Chiriqui, Panama; 1 male.

*Type*.—Cat. No. 9149, U.S.N.M.

Genus EPIPLEMA Herrich-Schaeffer.

EPIPLEMA EXCORIA, new species.

*Forewing*.—Gray, with somewhat of a slaty tinge and sparsely black speckled costa with short dark striæ; lines fine, first at one-third, oblique outward from costa, apparently bluntly bent in midwing, then oblique inward; outer line at two-thirds, oblique and straight inward; in the narrow interval between the lines a blackish blotch between

veins 4 and 6; faint traces of a submarginal shade with some black dots on veins; a brown crescentic shade before excision with one or two black dots, fringe brown, blackish, tipped at the teeth.

*Hindwing*.—With both lines brownish, curved parallel to each other; some pale bluish white scales toward hind margin.

Under side slaty gray, darker in forewing, all veins dotted with black.

Head, thorax, and abdomen concolorous; face black; fillet narrowly white.

*Expanse of wings*.—18 mm.

*Localities*.—Orizaba, Mexico, 1 male; Cordoba, Mexico, 1 female.

Forewing excised between veins 4 and 6, hindwing between 4 and 7 and again at submedian fold; the excisions and the teeth more prominent in female than in male. Abdomen of male elongate, with tuft of ochreous hairs.

*Type*.—Cat. No. 9150, U.S.N.M.

Genus GATHYNIA Walker.

GATHYNIA CASSATA, new species.

*Forewing*.—Grayish buff, paler, more ochreous toward apex; costal area for four-fifths, as far as middle of cell, gray with brown freckling; at four-fifths a lunulate-dentate gray line runs vertically to vein 6, is there interrupted and bent outward, reaching inner margin at three-fourths as an oblique double black line filled in with brown, followed by a pale band before the brown-black anal angle; a line of minute black dots between veins before margin; fringe ochreous, mottled with brown and with a pale base.

*Hindwing*.—With apical half above vein 6 and inner area below vein 2, pale straw-color; inner line black, angled on median; outer line also angled on median, bright brown, edged inwardly with blackish and outwardly by a fine lustrous line, followed in upper half by a dark shade; a round ochreous cell spot at upper end of discocellular; space between costa and vein 2 irregularly darkened by brown and fuscous scales; beyond outer line some brown scales between 6 and 4, and the interval between 3 and 4 filled up with leaden-black; an olive-brown shade, inwardly edged by black lunules, from before upper and below lower tooth; fringe brown, with a pale lustrous line at base.

Under side of forewing brownish ochreous, with dark speckling and a black blotch at anal angle; hind margin brownish beyond a pale sinuous band; hindwing whitish ochreous, with some gray-brown scales in costal tuft at base; fringe brownish around tooth at vein 7.

Thorax and patagia buff; abdomen ochreous, with a black belt at base, and the dorsum fringed with smoky gray; shoulders ochreous-gray; head and forelegs dark brown; palpi black.

*Expanse of wings.*—24 mm.

*Locality.*—Jalapa, Mexico; 1 female. I have seen another female from Huatuxco, Vera Cruz. Near *Gathynia dilacerata* Guenée.

*Type.*—Cat. No. 9151, U.S.N.M.

**GATHYNIA OCHRIENNIS, new species.**

*Forewing.*—Ochreous, almost wholly covered with brownish gray, only the apex remaining narrowly dull ochreous; costa dotted light and dark; at three-fourths a double gray crenulate line can be traced from costa to cell, interrupted by the brown-gray shading below middle and reaching inner margin as an oblique brown streak edged with darker, but the edges not parallel as in *cassata*, followed by a grayish-yellow short band; the anal region and extreme hind margin dusky gray, with some irregular black spots before it; fringe gray, mottled with ochreous.

*Hindwing.*—With the same markings as *cassata*, but the pale ground color yellowish ochreous, smeared with gray; a blotch between veins 4 and 5 before hind margin; a small spot in cell below the cell spot and a blotch on costa before apex are pure yellowish.

Under side of forewing gray-brown, narrowly ochreous along costa and again on inner margin; hindwing yellowish, with gray scales in basal tuft on costa and toward apex.

Head, thorax, and abdomen gray; the basal black belt of abdomen very broad; face and foreleg dark brown.

*Expanse of wings.*—26 mm.

*Locality.*—Orizaba, Mexico; 1 female.

Much like *G. cassata*, but quite distinct.

*Type.*—Cat. No. 9152, U.S.N.M.

**Genus NEODETA, new genus.**

*Forewing.*—Elongate; costa straight; apex rounded; hind margin oblique, without teeth; inner margin sinuate; a fovea in both sexes between submedian and median veins at base.

*Hindwing.*—Costa shouldered near base, insinuate in middle; apex truncate to end of vein 7, where there is a blunt tooth; margin below it straight, rounded before anal angle, prominent.

Antennæ thick, lamellate; palpi short, porrect.

*Neuration.*—Forewing, cell half as long as wing, broad; discocellular vertical; veins 2 and 3 stalked; 5 from near middle of discocellular; 6, 7 stalked; 8, 9 stalked; 10, 11 from cell; hind wing with normal neuration; in the male with median nervules hidden.

*Type.*—*Neodeta ochriplaga*, new species.

**NEODETA FASCIATA, new species.**

*Forewing*.—Purplish gray, black speckled; no inner line; outer line at three-fourths, vertical from subcostal to vein 1, incurved at each end, black and thick, slightly produced inward along the veins, followed by a broad band of pinkish white, thickly filled with gray striæ, which are darker at each end; marginal area again dark, united baseward by a dark waved line; fringe fuscous, with a pale basal line.

*Hindwing*.—With a curved inner and outer black line, the latter indented on vein 7; the pale band following much narrower than in forewing; the basal area similarly pale; the dark marginal area with a triangulate black streak from costa before apex.

Under side of forewing dark fuscous, of hindwing pale gray, with darker striation.

Head, thorax, and abdomen, fuscous-gray; the abdomen with blackish bands corresponding to the dark lines of hindwing; face and palpi black.

*Expanse of wings*.—17 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana, November, 1904; 1 female.

*Type*.—Cat. No. 9153, U.S.N.M.

**NEODETA NANA, new species.**

*Forewing*.—Smoky purplish black, with indications of a thick inner line on inner margin; a fairly distinct outer line at three-fourths, strongly outcurved in upper half and on inner margin parallel to inner line; a dark shade before hind margin.

*Hindwing*.—With dark curved outer line, faintly edged with fulvous.

Under side dark fuscous.

Head, thorax, and abdomen all dark fuscous.

*Expanse of wings*.—15 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

*Type*.—Cat. No. 9154, U.S.N.M.

**NEODETA OCHRIPLAGA, new species.**

*Forewing*.—Dull dark fuscous, without markings, except a short streak from before apex along hind margin consisting of three black angulate marks.

*Hindwing*.—Dark brown, with a narrow curved central fascia, edged inwardly by a simple curved darker line, and outwardly minutely crenulate; it is preceded and followed by a paler shade mixed with ochreous scales, which swell out into a blotch on costa before apex before a triangulate black line, the furrow white.

Under side of forewing dull fuscous, of hindwing whitish gray with dark speckling.

Head, thorax, and abdomen all dark fuscous; anal tuft ochreous.

*Expanse of wings*.—19 mm.

*Locality*.—São Paulo, southeast Brazil; 1 male.

*Type*.—Cat. No. 9155, U.S.N.M.

Genus NOTOPTYA, new genus.

Characterized by the structure of the hindwing in the male. The hind margin at vein 2 runs up basewards parallel to costa for one-third; the shortened inner margin is amplified with a wide lobe which meets the corresponding lobe and covers the dorsum; the hind margin is indented beyond cell; anal segment armed laterally with two broadly rounded flaps. In forewing vein 5 rises from near the upper angle of cell, 6, 7 are stalked, as in *Epiplema*.

*Type*.—*Notoptya fuscularia*, new species.

NOTOPTYA FUSCULARIA, new species.

*Forewing*.—Dull fawn-color, with scattered dark scaling; the lines fine, dark; inner line indistinct, angled outward on median vein; outer line from two-thirds of costa, vertical to middle, then inwardly oblique, parallel to inner line below, narrowly edged with paler; marginal third paler, with a dark cloud at anal angle; a row of four black spots from below apex to below middle of hind margin, the extreme margin beyond them darker, fringe concolorous, with a fine pale line at base.

*Hindwing*.—With curved outer line and traces of an inner line; two minute dark spots before the teeth; fringe darker.

Under side like upper, but darker in forewing.

Head, thorax, and abdomen like wings; face and vertex concolorous.

*Expanse of wings*.—16 mm.

*Locality*.—São Paulo, southeast Brazil; 1 male.

*Type*.—Cat. No. 9156, U.S.N.M.

Genus SICULODOPSIS Warren.

SICULODOPSIS DUBIA, new species.

*Forewing*.—Dingy pale gray, freckled with darker; the costa, apex, and hind margin diffusely darker; a brown cell spot and a very indistinct outer shade at three-fourths; fringe dark gray.

*Hindwing*.—With cell spot, and traces of a gray curved submarginal line, under side of forewing dull dark gray with large cell spot; of hindwing whitish gray with a few speckles.

Thorax and abdomen gray; head wanting.

*Expanse of wings*.—26 mm.

*Locality*.—Ecuador; 1 male.

*Type*.—Cat. No. 9157, U.S.N.M.

## SICULODOPSIS GRACILINEA, new species.

*Forewing*.—Pale fawn-gray, sprinkled with irregular faint brown striae; the lines slender, brown; first only visible below subcostal vein, oblique inward, interrupted and wavy, at one-third; outer line from middle of costa oblique outward to vein 7, then oblique and straight inward; fringe concolorous.

*Hindwing*.—With the outer line alone distinct, the costal area paler.

Under side pale stone-gray, with short transverse striae between veins.

Thorax and abdomen concolorous with wings; head, shoulders, and patagia pale yellowish; palpi above dark brown, below pale.

*Expanse of wings*.—26 mm.

*Locality*.—Peru; 1 male.

*Type*.—Cat. No. 9158, U.S.N.M.

## Family GEOMETRIDÆ.

## Subfamily CENOCHROMINÆ.

## Genus DOLICHONEURA Warren.

## DOLICHONEURA NIGRINOTATA, new species.

*Forewing*.—Pale lilac-gray, sparsely dusted with blackish scales; a large black cell spot; outer line commences as an oblique black streak from costa at two-thirds, which at vein 6 is angled and runs irregularly lunulate-dentate to two-thirds of inner margin; it is closely followed throughout by a dark or waved band rising on costa before apex, and between veins 3 and 4 is preceded by a brown blotch; submarginal line waved, pale, followed by a darker shade; fringe brown, preceded in the male by three or four black marginal dots below apex, in the female by a sinuous black line as far as vein 5; in both sexes there are traces of a waved inner line at one-fourth.

*Hindwing*.—Similar; the basal line distinct, the marginal area broader.

Under side uniform pale gray, darker in the female.

Face, collar, and palpi black; thorax and abdomen gray like wings; forelegs in front blackish.

*Expanse of wings*.—Male, 40 mm.; female, 38 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana.

*Type*.—Cat. No. 9159, U.S.N.M.

## Genus OBELOPTERYX, new genus.

*Forewing*.—Three times as long as wide; costa straight; curving before apex; hind margin very oblique.

*Hindwing*.—Narrow, hind margin curved; apex rounded; inner margin short; hind margin slightly indented before anal angle.

Antennæ of female pubescent, the segments slightly angled; palpi upcurved in front of face, rough-haired beneath; tongue and frenulum present.

*Neuration*.—Forewing; cell longer than half of wing; discocellular slightly inangled at middle; first median nervule at seven-eighths; second close before third; radials normal; 7, 8, 9 stalked, 10 and 11 from cell; 10 anastomosing with 11, and again with 8, 9; hindwing, costal approximating to subcostal for half of cell; 6, 7 stalked; radial from center of discocellular; medians at even distance from each other.

*Type*.—*Obelopteryx angusta*, new species.

The genus would seem to be analogous to *Erannis*, but the wings of the female are fully developed.

**OBELOPTERYX ANGUSTA, new species.**

*Forewing*.—Brownish gray, with a reddish tinge, lines starting from dark costal streaks, at first oblique outwards, then waved; first at one-third; median before dark cell spot; outer at three-fourths, acutely angled on vein 6, then parallel to hind margin, approaching middle line on inner margin; submarginal line pale, between two reddish shades, plainest below near inner margin, a slight marginal line interrupted at the veins; fringe pale, checkered with dark.

*Hindwing*.—Without inner line; the rest all oblique and parallel.

Under side paler, with the lines indicated.

Head, thorax, and abdomen like wings; face pale gray.

*Expanse of wings*.—28 mm.

*Locality*.—Peru; 1 female.

*Type*.—Cat. No. 9160, U.S.N.M.

**Genus PYCNONEURA Warren.**

**PYCNONEURA RECTILINEATA, new species.**

*Forewing*.—Male brownish slate-color, sprinkled in parts with bluish white scales, especially along costa and hind margin; lines thick, dull chocolate-brown; first from one-fourth of costa to one-fourth of inner margin; projecting in cell toward the black cell spot, then oblique inwards; outer line from two-thirds of costa oblique outward to vein 6, there right angled and straight to three-fifths of inner margin; both lines edged on each side with bluish white scales; submarginal line irregularly dentate, formed of bluish white scales; marginal line and fringe dark; some black marginal spots below apex.

*Hindwing*.—With the lines basal and central; the submarginal well marked, strongly zigzag; the whole wing more densely sprinkled with bluish white scales, especially along outer and inner margins.

Under side uniform dull brownish slate-color.

Head, thorax, and abdomen like wings; face and palpi black; shoulders sprinkled with gray; dorsum with white triangles on first four segments behind.

*Expanse of wings*.—46 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana.

*Type*.—Cat. No. 9161, U.S.N.M.

Subfamily CYLLOPODINÆ.

Genus ATYRIA Felder.

ATYRIA CRUCIATA, new species.

*Forewing*.—Black, with two large yellow blotches; one along submedian vein from near base to two-thirds, its upper edge uniformly rounded, touching median vein; the other an elongated oval, its summit straight and oblique, its outer edge well curved, from costal vein to vein 2; fringe black.

*Hindwing*.—Yellow, with black margins, that along costa broadest, narrowed on hind margin, and running up to a point at base of inner margin; from the costal margin which extends over the basal half of cell a black streak runs along vein 2 to the hind margin, broad at end of cell with a diffuse fork on vein 1.

Under side the same, but the black duller.

Head and thorax black; the abdomen ochreous, with a narrow pale lateral stripe; legs cinereous.

*Expanse of wings*.—40 mm.

*Locality*.—Bolivia; 1 male.

*Type*.—Cat. No. 9162, U.S.N.M.

Genus CACOLYCES, new genus.

Like *Lyces* in shape of wing, but differing in neurulation and in the antennæ; the cell is less than half as long as wing; the discocellular with the short upper third vertical, the lower two-thirds very oblique; the two radials, swollen at their origin, close together from the upper arm; veins 3 and 4 from end of cell; 10, 7, 8, 9 stalked, 11 free; hindwing with discocellular triangulate, the radial from the outward lower angulation; veins 3, 4 close together from the lower end of cell; 6, 7 stalked. The pectinations of the antennæ of the male are fine, short, and regular.

*Type*.—*Cacolyces plagifera* Walker (*Lyces*).

Genus CYLLOPODA Dalman.

CYLLOPODA BIPUNCTA, new species.

*Forewing*.—Black, with two yellow blotches, the first, from base between the median and submedian veins, reaching about two-thirds, its end rounded at top and hardly oblique; the other long and irregular from below costa beyond middle to vein 1; fringe black, with the apical tips white.

*Hindwing*.—Yellow; the inner margin narrowly black; the hind margin more broadly, increasing in breadth to before apex, where it is squarely cut off; a black spot at extreme base of wing and another at the upper end of the discocellular.

Under side the same.

Face, shoulders, and patagia at base, yellow; vertex and thorax, black; abdomen, dark cinereous above, with a yellow lateral stripe, underneath silvery white; legs, white, externally fuscous.

*Expanse of wings*.—35 mm.

*Locality*.—Peru; 1 male.

*Type*.—Cat. No. 9163, U.S.N.M.

#### CYLOPODA RADIATA, new species.

*Forewing*.—Purplish black, with two large pale yellow blotches, one wedged-shaped, from base between median vein and submedian, the bluntly rounded end on the submedian fold at two-thirds, with a short yellow streak above it at middle of cell; the other a large oval, from costal vein at two-thirds to vein 2 near hind margin, its outer edge more curved and slightly waved from vein to vein.

*Hindwing*.—Yellow, with the hind inner margin black, the border beginning on costa before apex and gradually narrowing to a point at base of inner margin; a diffusely edged streak running from base of cell along median vein and vein 2 to the margin.

Under side with the yellow space broader; the hindwing without the streak from base, and the border stopping short at anal angle.

Head and thorax, purplish black; dorsum, dull cinereous; the abdomen long, with anal parts yellowish; abdomen below, white; pectus and legs, yellow.

*Expanse of wings*.—46 mm.

*Locality*.—Nova Friburgo, Brazil; 1 male.

*Type*.—Cat. No. 9164, U.S.N.M.

#### Genus DIALEPHTIS Felder.

#### DIALEPHTIS CELATA, new species.

*Forewing*.—Brown, darker toward base of costa and toward hind margin, where the inner side is black; the veins dull ochreous; a small dull orange spot below costa between veins 10 and 11; fringe, dark brown.

*Hindwing*.—Orange, with a black marginal border, commencing at a point on costa at two-thirds and widening outwards, broadest along lower half of hind margin, and ending in a point on inner margin above anal angle; the base dusted with dark.

Under side of forewing orange, with a black-brown basal blotch on costa reaching two-thirds of cell and there right angled, the costal and

subcostal veins paler across it at base; a broad brown border, starting obliquely from beyond middle of costa, narrowing along inner margin; hindwing as above.

Palpi and face orange below, black above; vertex blackish; collar and base of shoulders orange; thorax and abdomen cinereous; dorsal and lateral streaks dull orange; abdomen beneath whitish.

*Expanse of wings*.—40 mm.

*Locality*.—Cajon, Peru; 1 female.

*Type*.—Cat. No. 9165, U.S.N.M.

#### Genus EPHIALTIAS Hübner.

##### EPHIALTIAS MORENA, new species.

*Forewing*.—Black-brown, with the veins showing paler; a narrow straight chrome-yellow band from costal vein beyond middle to vein 1, just before anal angle; its outer edge a little outcurved below middle and incurved to meet lower end of inner edge; fringe black-brown.

*Hindwing*.—Black, with a broad chrome-yellow central band from middle of inner margin, which is narrowly black, to one-third from apex, touching above the stalk of veins 6, 7.

Under side the same, the yellow areas broader.

Head, thorax, and abdomen above and below black.

*Expanse of wings*.—44 mm.

*Locality*.—Rio Grande do Sul, Brazil; 1 male.

*Type*.—Cat. No. 9166, U.S.N.M.

#### Genus EUCHONTHA Walker.

##### EUCHONTHA CASTRONA, new species.

*Forewing*.—Brown-black, with a bell-shaped white blotch beyond discocellular, the rounded end basewards, the two radials marked dark on it at their origin; fringe black.

*Hindwing*.—Wholly black.

Under side of forewing brown-gray, with all the veins black along costa and at apex; the rest of the wing smoky black, with the white blotch in the middle; hindwing pale gray, with all veins black and traces of an outer cloud.

Thorax and abdomen smoky black; patagia with a yellow and white streak from base; thorax with a pale central line; antennæ black; face and vertex pale yellow; abdomen beneath white.

*Expanse of wings*.—38 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

*Type*.—Cat. No. 9167, U.S.N.M.

## Genus POLYPÆTES Druce.

## POLYPÆTES ANIPLATA, new species.

Differs both from *P. obtusa* Walker and *P. rufipuncta* Schaus in the white space of forewing beyond the cell being much larger and clearer white, forming an oblong patch reaching halfway from cell to hind margin; in the hindwing, while the inner margin is broadly black as in *rufipuncta*, it shows traces of snowy white between the veins; on the under side the whole hindwing is white with a black border round the hind margin, beginning narrowly at two-thirds of costa and ending at anal angle, its inner edge with an acute indentation below vein 3.

*Expanse of wings*.—34 mm.

*Locality*.—Bolivia; 1 female. Can this be the female of *rufipuncta* Schaus?

*Type*.—Cat. No. 9168, U.S.N.M.

## Genus SCEA Walker.

## SCEA OBLIQUARIA, new species.

Superficially very much like *S. auriflamma* Hübner, but both wings are narrower and longer; in the forewing the edge of the dark apical area runs oblique and straight, not curved, from two-thirds of costa to above anal angle, and the inner margin is more evenly black.

*Expanse of wings*.—29 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

*Type*.—Cat. No. 9169, U.S.N.M.

## Genus SCOTURA Walker.

## SCOTURA DISCOLOR, new species.

Differs from *S. flavicapilla* Hübner in having darker cross lines minutely lunulate between the veins, inner, postmedian and submarginal; similar lines but more distinct are seen in *S. nervosa* Butler, but that species has the head unicolorous, whereas in *discolor* it is yellow as in *flavicapilla*.

*Expanse of wings*.—30 mm.

*Locality*.—Rio Janeiro, Brazil; 1 female.

*Type*.—Cat. No. 9170, U.S.N.M.

## SCOTURA NIGRATA, new species.

*Forewing*.—Male blackish, the veins paler; fringe concolorous.

*Hindwing*.—Black, with an elongated pale space from base along cell and median nervules to two-thirds of wing, covered with gray hairs.

In the female the discocellular is black, with a faintly pale and roundish space beyond its lower end, corresponding to the extremity of the pale central space of hindwing.

Under side pale, more slaty black; the white central area of hindwing more developed and without gray hairs.

Vertex, head, palpi, and pectus orange; thorax and abdomen like wings.

*Expanse of wings*.—Male, 26 mm.; female, 30 mm.

*Localities*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904; Rockstone, Essequibo, British Guiana; 1 female, September, 1904.

*Type*.—Cat. No. 9171, U.S.N.M.

### Genus STENOPLASTIS Felder.

#### STENOPLASTIS TRANSVERSA, new species.

*Forewing*.—Black, with the veins pale; a broad transverse yellow band from costa somewhat before middle to inner margin beyond middle; fringe black.

*Hindwing*.—Black; the costa pale from base, ending in a small yellow blotch representing the end of the band of forewing.

Under side grayer black; the yellow paler and more extensive.

Head, palpi, and corslet yellow; thorax and abdomen blackish cinereous; tips of palpi black; under side of abdomen and legs pale gray.

*Expanse of wings*.—27 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

*Type*.—Cat. No. 9172, U.S.N.M.

### Genus XENOMIGIA, new genus.

*Forewing*.—Costa and hind margin both slightly curved; apex rounded.

*Hindwing*.—Ample, wider than forewing and nearly as long; both angles and the hind margin rounded.

Antennæ of male tuberculate beneath, each tubercle armed on each side with paired fascicles of cilia, each ending in free cilia; palpi rough, upcurved in front of face; terminal segment obscure; face narrow, the eyes being large; tongue and frenulum well developed; hind legs broken.

*Neuration*.—Forewing, cell longer than half of wing; discocellular short, vertical; the subcostal vein abruptly bent down at end; first median nervule at two-thirds, second at five-sixths; radials close together, the upper from the end of the depressed subcostal; veins 10, 9, 8, 7 stalked from the bend, 10 very shortly stalked; 9 rising before the fork of 8, 7, instead of 7 rising before the fork of 8, 9; 11 free.

*Hindwing*.—Costal approximated to subcostal; veins 6, 7 stalked; discocellular triangulate, the radial from the outer angulation; medians as in forewing; scaling fine and hairlike; wings toward base semi-transparent.

*Type*.—*Xenomigia veninotata*, new species.

**XENOMIGIA VENINOTATA, new species.**

*Forewing*.—Olive-ochreous; the markings blackish, at the veins pale; the base of veins 2, 3, 4 swollen, cream-white; a cloudy blackish spot on costa close to base; a short curved somewhat dentate streak at two-fifths, an oblique dark mark in middle of cell, and a blackish blotch above inner margin at one-third, followed by a cream-colored spot between submedian fold and vein; a blackish dentate streak from costa at two-thirds, curved inwards below middle, touching the pale bases of the median nervules and ending in a large cloudy blotch at middle of inner margin; a submarginal dentate-edged black shade, followed by an irregular band of cream-color, which runs inwards above veins 2 and 4, interrupting the black shade, edged externally by another black shade interrupted at each pale vein; thick marginal dashes between the veins; fringe pale ochreous.

*Hindwing*.—Dull olive-gray; towards base thinly scaled and semi-transparent; fringe pale.

Under side of both wings like upper side of hindwing; fringes pale ochreous.

Head, thorax, and abdomen olive-gray; palpi darker; legs dark olive-gray.

*Expanse of wings*.—37 mm.

*Locality*.—Colombia; 1 male.

The forewings of the unique specimen are both somewhat rubbed at base, and the description thereof necessarily incomplete in detail.

*Type*.—Cat. No. 9173, U.S.N.M.

**Subfamily GEOMETRINÆ.**

**Genus ANOPHYLLA Warren.**

**ANOPHYLLA OBELISCATA, new species.**

*Forewing*.—With the central area above submedian vein and the costal area above subcostal green; all the rest cream-white with an iridescent pink tinge and sprinkled with purplish scales in places; a pear-shaped pale blotch occupies the base of cell and submedian interval; the pale marginal border is traversed by two parallel waved bands; the inner narrow and purplish, the outer broader and more brownish; the outer edge of the green central area projects squarely into the pale border between veins 3 and 4; on the discocellular is a broad pale lunule, the lower end of which is prolonged bar-like between

veins 4 and 5 to touch the pale border, its center bearing a line of rose-colored scales; a fine interrupted purplish brown marginal line; fringe cream-colored.

*Hindwing*.—With the green area still more restricted, not reaching above subcostal vein, the pale basal patch much larger; discocellular with an oval white spot at top joined by a fine curved line to another below, from which the pointed streak runs to the border.

Under side iridescent white, with the dark and light shades showing through.

Palpi above and front of forelegs reddish brown; face greenish above, paler below; vertex white; shoulders, thorax, and base of patagia green; tips of patagia purplish; abdomen greenish at base, becoming whitish toward anal segment, the dorsal crests reddish.

*Expanse of wings*.—Male, 50 mm.

*Locality*.—Omai, British Guiana.

*Type*.—Cat. No. 9174, U.S.N.M.

#### Genus COMIBÆNA Hübner.

##### COMIBÆNA FLAVICOMA, new species.

*Forewing*.—Grass-green, without markings, except a gray patch on inner margin, before middle below vein 1; cell spot black; fringe greenish yellow.

*Hindwing*.—Green, with a large primrose basal patch, edged by a thick black line, angled on vein 6 and again on 4, then incurved and purplish, followed by a rusty line, which is only clearly separate above 6 and below 4; the extreme base and inner margin narrowly green; fringe pale green.

Under side paler, yellow-green; costa of forewing yellow; inner margin of forewings, costa of hindwing, and the basal patch whitish.

Face and vertex snow-white; thorax and abdomen green, abdomen beneath, and legs white; antennæ white, yellowish beneath.

*Expanse of wings*.—19 mm.

*Locality*.—Surinam River, Dutch Guiana; 1 male.

*Type*.—Cat. No. 9175, U.S.N.M.

#### Genus DRUCIA Warren.

##### DRUCIA EXCRESCENS, new species.

*Forewing*.—Very pale, greenish, semihyaline; the markings deep brick-red, with darker red-brown striæ; a small diffusely edged patch at base, followed by an oblique oval blotch from median vein to inner margin; outer half of wing brick-red, its inner edge lunulate between the veins, containing a sinus of pale ground-color between 3 and 4, which curves downward at its extremity nearly to vein 2; fringe

yellow, with red checkering beyond veins; costa yellowish; cell spot minute, red.

*Hindwing*.—With the red margin narrower; its inner edge excavated beyond cell and the lower sinus broader and rounder; the anal blotch connected along inner margin with a semicircular red blotch before middle; base slightly red.

Under side iridescent yellowish green, the red markings showing through strongly.

Head, thorax, and dorsum all deep red, the crests metallic; vertex white; abdomen beneath and legs greenish ochreous.

*Expanse of wings*.—Male, 24 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Closely allied to *D. jaspidata* Warren, differing in the basal markings of both wings.

*Type*.—Cat. No. 9176, U.S.N.M.

**DRUCIA QUINQUEMACULATA, new species.**

*Forewing*.—Pale yellowish green; the costal edge white; cell spot small, red-brown; a large brown blotch at apex reaching to below vein 4, a smaller rounded one at anal angle; both blotches densely striated with fuscous internally, their marginal areas flesh-color; an interrupted dark brown marginal line; fringe worn.

*Hindwing*.—With the apical blotch narrower, reaching only to vein 4; the anal blotch connected along inner margin with a long semi-oval blotch from base.

Under side pale green, with both apical blotches and the anal blotch of forewing marked.

Face, palpi, forelegs, thorax, and abdomen brown; vertex white; shoulders green (probably the patagia, also); dorsal tufts dark brown.

*Expanse of wings*.—Female, 36 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Hind margin of forewing bent at middle, oblique below; of hindwing slightly toothed at 4 and 6, excised between.

*Type*.—Cat. No. 9177, U.S.N.M.

**DRUCIA SEMISPURCATA, new species.**

*Forewing*.—Pale green, freckled toward base with olive-gray, and in the outer half more densely with olive-fuscous partially confluent striæ; costal edge white; costal area at base olive-gray; a dark cell spot; on hind margin in and beyond the cell and sometimes extending to apex is a patch of unspeckled green; fringe whitish.

*Hindwing*.—With basal third unspeckled green; outer two-thirds more densely covered with fuscous mottling, especially along inner margin and at anal angle; cell spot fuscous; fringe whitish.

Under side dull pale green, the darker speckling showing through.

Face, palpi, and dorsum olive-green; vertex and antennæ white; thorax and base of abdomen green; dorsal tufts (worn) dark fuscous; abdomen below and legs whitish green.

*Expanse of wings*.—Female, 37 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Forewing with hind margin below vein 3 very oblique; hindwing distinctly elbowed at vein 4 and slightly excised between 4 and 6.

*Type*.—Cat. No. 9178, U.S.N.M.

#### Genus GELASMA Warren.

##### GELASMA SUBRUFESCENS, new species.

*Forewing*.—Dull grayish green; costa yellow with purple specks, lines whitish, marked by whitish spots on veins (in the larger of the two females the outer line is continuous and waved) at one-third and two-thirds; marginal line distinct, purplish, interrupted by yellow dots on veins; fringe yellowish, checkered broadly with purplish gray; cell spot hardly marked, darker green.

*Hindwing*.—Without first line.

Under side of forewing dull gray; the costa and fringe yellowish; of hindwing yellowish green with a rosy blotch at apex; the male is less rosy than the female.

Face, palpi, and antennæ brownish red; vertex whitish; thorax and abdomen dull green, the latter with reddish scales along dorsum.

*Expanse of wings*.—17 to 20 mm.

*Localities*.—One male and 2 females from St. Jean and St. Laurent, Maroni River, French Guiana; the female from St. Laurent larger than the other pair.

Exceedingly like *G. hemethearia* Warren from South Brazil, but distinguished by the red under side, besides which the neuration is different; in the present species veins 6, 7, 8, 9, 10, and 11 are all stalked together; in *hemethearia* 11 is separate.

*Type*.—Cat. No. 9179, U.S.N.M.

#### Genus MELOCHLORA Warren.

##### MELOCHLORA AFFINIS, new species.

*Forewing*.—Deep green; costa with sparse fuscous dots; lines olive-color, straight; the outer parallel to hind margin; the inner more obscure, hardly marked above median vein; a small black cell spot; a red-brown blotch of confluent striæ from anal angle to vein 4, with a small blotch above it below vein 6; a black marginal line from anal angle to above vein 2 and a black spot at apex; fringe green, blackish at apex and anal angle.

*Hindwing*.—With broad median olive line, faintly edged outwardly with paler; a small dark cell spot; a few reddish striæ toward apex; a

marginal black line from apex and dark marginal spots between veins above middle; fringe black at apex, green below; the dark fasciæ of the under side show through.

Under side pale green, especially in hindwings; a dull black submarginal fascia from vein 6 broadened at anal angle and continued equally broad across hindwing from apex to vein 1 above anal angle; hindwing with antemedian black fascia not reaching either margin.

Head, thorax, and abdomen green, the last with small white dorsal points; palpi ochreous.

*Expanse of wings.*—Male, 33 mm.

*Locality.*—St. Laurent, Maroni River, French Guiana.

Very close to *M. neis* Druce (*Tachyphyle*) from Mexico, the chief difference being the absence on the under side of forewing of the dark blotch along inner margin; the hindwing above is also less thickly striated.

*Type.*—Cat. No. 9180, U.S.N.M.

#### MELOCHLORA GENUFLEXA, new species.

*Forewing.*—Dull green, with faint fuscous striation, chiefly in the marginal area; lines dull fuscous; first curved from one-fourth of costa to one-third of inner margin, green and obscure above median; outer from three-fourths of costa to two-thirds of inner margin, bent parallel to hind margin, elbowed outwardly on vein 3 and inwardly on submedian fold; space between the lines on inner margin somewhat darker; a small black cell spot; fringe green.

*Hindwing.*—With the dark basal shade of the under side showing through before the black cell spot; outer line as in forewing, but more curved.

Under side pale green, glossy; forewing with a black lunate-edged submarginal fascia from vein 6 to anal angle, appearing on hindwing as a costal blotch before apex; a curved dark fascia near base from subcostal of hindwing to inner margin.

Face, thorax, and base of abdomen green; palpi greenish white; vertex white; anal segments of abdomen tinged with gray.

*Expanse of wings.*—Female, 32 mm.

*Locality.*—St. Jean, Maroni River, French Guiana.

The elbow of hind margin scarcely perceptible.

*Type.*—Cat. No. 9181, U.S.N.M.

#### MELOCHLORA HYDATODES, new species.

*Forewing.*—Bright pale green along costa and hind margin to anal angle; a greenish white semihyaline space extending to middle of wing from the middle of costa, its lowest point white and occupying the space between the base of veins 3 and 4; all the rest of the wing suf-

fused with leaden-purple; at two-thirds of inner margin a darker line is visible as far as the base of veins 3 and 4, and another parallel just beyond it; costa creamy-white; fringe broad and silky, whitish green, dark at anal angle.

*Hindwing*.—Wholly leaden-purple except a bright green strip along hind margin from apex to anal angle; a distinct black cell spot; fringe greenish white throughout.

Under side smoky blackish, the pale green spaces of the upper side all pale ochreous, with a faint greenish tinge.

Face and palpi ochreous (perhaps faded); vertex and shaft of antennæ white; thorax green; abdomen ochreous tinged with green.

*Expanse of wings*.—Male, 24 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

The long, silky fringe, as well as the blunter angle of the hindwing, will distinguish this species from *M. obnubilata*, to which it bears a curious resemblance.

*Type*.—Cat. No. 9182, U.S.N.M.

**MELOCHLORA OBNUBILATA, new species.**

*Forewing*.—Bright green along costal and hind margins, with a paler green area reaching to median vein between the two lines; the rest of the wings suffused with dull fuscous-olive; the lines dark and thick; outer line at three-fifths, parallel to hind margin, followed by a leaden-gray tinge, inner line curved, obscure above middle; cell spot small, dark; a dark spot in submedian interval toward anal angle; fringe pale green above middle; darker below, with a black apical dot.

*Hindwing*.—Wholly suffused with fuscous-olive except the hind-margin below middle; a dark line just beyond middle edged with plumbeous; cell spot larger, blackish; fringe pale green below middle, darker above.

Under side pale green with the dark areas dull blackish.

Head, shoulders, and patagia bright green; abdomen duller green; under side of abdomen, legs, and palpi pale ochreous.

*Expanse of wings*.—Male, 27 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

The angle at middle of hindwing and the bulge in forewing strongly marked.

*Type*.—Cat. No. 9183, U.S.N.M.

**MELOCHLORA VAGILINEA, new species.**

*Forewing*.—Pale green, with very spare red-brown striæ; from three-fifths of inner margin a thick red-brown roughly lunulate-dentate line runs parallel to hind margin to vein 6, indicated by a dot only on vein 7, the marginal area beyond it, as far as vein 6, filled up with dull dark brown, slightly paler, more reddish in the middle; fringe and

apical spot brown; a minute dark cell dot; inner line indicated by a few red scales; costa dotted with dark green.

*Hindwing*.—With the outer line distinctly lunulate-dentate, dark brown near costa, reddish below; only the apical portion of outer area dark brown, the rest striated with reddish; fringe black-brown above middle, green below.

Under side paler, the hindwing and inner margin of forewing whitish green; the dark marginal area blacker; both wings with an inner round dark blotch in submedian space, the hindwing with a second in cell, forming an incomplete band.

Face olive; palpi pale green, externally fuscous; vertex white; back of crown, thorax, and abdomen green, the last with white dorsal dots.

*Expanse of wings*.—Male, 36 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

*Type*.—Cat. No. 9184, U.S.N.M.

#### Genus MIANTONOTA Warren.

##### MIANTONOTA RECTILINEA, new species.

*Forewing*.—Uniform pale green; the costal edge white; a small dark cell spot; a straight white outer line at two-thirds, parallel to hind margin; fringe yellowish white, with a slight red spot at apex and anal angle.

*Hindwing*.—With the line slightly bent on vein 3.

Under side whitish green.

Face and palpi red; fillet and antennæ white; vertex, thorax, and abdomen green; dorsum with a large deep purplish black spot on second and fifth segments; anal segments, under side and legs whitish.

*Expanse of wings*.—Female, 35 mm.

*Locality*.—Baracoa, Cuba.

*Type*.—Cat. No. 9185, U.S.N.M.

#### Genus OOSPILA Warren.

##### OOSPILA SELLIFERA, new species.

*Forewing*.—Semihyaline green; hind margin irregularly dull purplish. This border begins narrowly at the apex, forms a small lunule above vein 6 and a larger projecting one on vein 5, narrowing from 4 to below vein 3, then running in for half the wing, rounded below cell spot and vertical to inner margin; fringe purplish (worn); cell spot small, dark.

*Hindwing*.—With the marginal border broader at apex, forming a distinct sinus outward below vein 4; cell spot dark at base of discocellular, with a silvery white spot at upper end.

Under side pale iridescent green, the dark margin showing through.

Face, basal joint of antennæ, and palpi above purplish; vertex and antennal shaft white; thorax and abdomen pale dull green; the dorsum tinged with purplish and with five purple crests.

*Expanse of wings*.—30 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

Nearest to *Oospila congener* Warren, from Rio Demerara; but that species has the marginal border entirely interrupted below middle of wing.

*Type*.—Cat. No. 9186, U.S.N.M.

#### Genus RACHEOLOPHA Warren.

##### RACHEOLOPHA CARNELUNATA, new species.

*Forewing*.—Sea-green; costal edge yellowish; cell spot brown; veins toward hind margin dark; marginal line black, preceded above middle by three pinkish white horseshoe-shaped blotches; a large one between veins 4 and 6, a smaller one between 6 and 7, and a minute one above 7; a still larger flattened blotch at anal angle. All these blotches are edged with dull purplish and connected by a similar purplish line running close to margin between veins 1 and 4; the veins through the blotches are also purple; fringe whitish, checkered with purplish beyond veins.

*Hindwing*.—Similar; the cell spot white at the tip end of the discocellular.

Under side pale iridescent green, marginal lines and fringe as above.

Face, palpi, and dorsal crests purplish; vertex and shaft of antennæ white; the pectinations rufous; thorax and base of abdomen green; anal segments, under side, and legs whitish; forelegs reddish in front.

*Expanse of wings*.—Male, 26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

*Type*.—Cat. No. 9187, U.S.N.M.

##### RACHEOLOPHA CÆRULEA, new species.

*Forewing*.—Blue-green; costa deep yellow; a row of fine purplish marginal dashes between veins; fringe ochreous checkered with pink.

*Hindwings*.—Similar, with a small discal white spot.

Under side whitish green; costa of forewing yellowish.

Face, palpi, and front of forelegs deep red; vertex white; thorax and abdomen blue-green; the tufts metallic brown; anal segments and under side of abdomen and the legs whitish ochreous.

*Expanse of wings*.—Male, 25 mm.

*Locality*.—Omai, British Guiana.

*Type*.—Cat. No. 9188, U.S.N.M.

**RACHEOLOPHA CONFLUARIA, new species.**

*Forewing*.—Sea-green; costa yellowish, strigulated at middle with reddish; a distinct reddish cell spot; an interrupted black marginal line, preceded by a continuous lunulate-edged border, filled up with dull brick-red and speckled with blackish, the blotch between 4 and 6 only slightly larger than those above it, connected by a broader and shorter space with the rounded blotch of anal angle; fringe brick-red, checkered with dark beyond veins.

*Hindwing*.—Similar; a white spot at top of discocellular and a small black one below middle.

Under side iridescent whitish green; marginal line and fringe as above; costa of forewing yellow; apex of hindwing narrowly fuscous.

Face and palpi red; vertex and antennæ white; thorax and dorsum green; dorsal tufts metallic brown, lined on each side with pink; anal segments, abdomen below, and legs, pale ochreous; forelegs reddish in front.

*Expanse of wings*.—Male, 28 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Very much like *R. carnulunata*, but the hindwing is bent at vein 4.

*Type*.—Cat. No. 9189, U.S.N.M.

**RACHEOLOPHA CONTINUATA, new species.**

*Forewing*.—Very pale green; semitransparent; costa whitish, with brown specks; cell spot minute, blackish; a broad dull red marginal border, nearly reaching middle of inner margin, projecting squarely between 4 and 6, with a rounded sinus of ground-color between 4 and 3; this border is striated with dark brown, edged with darker internally and along outer margin, especially toward apex shows traces of the green ground-color.

*Hindwing*.—Similar, but the apical patch larger and blacker, and the anal patch is connected along inner margin by a narrower brown streak with a semicircular brown patch not reaching base, where there is a distinct red spot.

Under side yellowish green, with the border showing purplish on forewing and blackish at apex of hindwing.

Head, thorax, and abdomen, red-brown; vertex white; shoulders and base of patagia green; dorsal crests metallic red; abdomen below and legs greenish white.

*Expanse of wings*.—Female, 23 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana.

*Type*.—Cat. No. 9190, U.S.N.M.

**RACHEOLOPHA DERASA, new species.**

*Forewing*.—Pale gray-green with slight bluish tinge; costal edge yellow; cell spot minute; an interrupted black marginal festoon, pre-

ceded at anal angle by a small patch of reddish fuscous scales; fringe white, checkered with red and black beyond veins.

*Hindwing*.—The same; the cell spot white at tip of discocellular.

Under side pale iridescent green; fringe and marginal line as above.

Face, palpi, and forelegs, red-brown; vertex white; thorax and abdomen green, the tufts metallic brown; abdomen beneath, the anal segments, and the legs, whitish.

*Expanse of wings*.—Male, 26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

*Type*.—Cat. No. 9191, U.S.N.M.

**RACHEOLOPHA RUBESCENS, new species.**

*Forewing*.—Dark sea-green; the costa distinctly yellow; marginal border flesh-colored with a few dark striations edged with purplish, the edge starting from below three-fourths of costa, forming a vertical curve to vein 6, then a long sinuate curve to below vein 2 near outer margin, then another sinuate curve backward touching cell spot beneath and ending vertically at one-third from base of inner margin; the border thus forming a large subquadrate apical patch and an elongated one on inner margin, connected with each other by a narrow, more striated neck between 2 and 4; cell spot black, erect; a purplish marginal line; fringe flesh-colored checkered with purplish.

*Hindwing*.—With the apical patch elongate and the anal patch much shorter, the neck between them stained with purplish; a narrow streak of flesh-color on inner margin in basal half connected by a purplish line with the anal patch.

Under side yellow-green, the patches showing through; marginal line and fringe as above.

Face, palpi, and forelegs deep red; metathorax and dorsum flesh-colored, the crests metallic red-brown; vertex white; shoulders, patagia, and thorax green; anal segments of abdomen, the under side and legs ochreous.

*Expanse of wings*.—Male, 22 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

*Type*.—Cat. No. 9192, U.S.N.M.

**RACHEOLOPHA EXTENSATA, new species.**

*Forewing*.—Yellowish green, the costal edge dull yellowish; a minute dark cell spot; a red-brown marginal border extending from apex to anal angle, swollen between 4 and 6, and from 3 to inner margin, with lunulate darker edges between the veins, except between 3 and 4, where the edge is straight; a dark marginal line; fringe yellow, with fine checkering of reddish beyond the veins.

*Hindwing*.—With the border broad at apex and anal angle, the edge somewhat abruptly angulated; inner margin green.

Under side dull yellowish green; the marginal border dark fuscous; a dark fuscous patch at base of costa of forewing.

Thorax and abdomen green, the dorsal crests red-brown.

*Expanse of wings*.—Male, 17 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

*Type*.—Cat. No. 9193, U.S.N.M.

**RACHEOLOPHA FLOREPICTA, new species.**

*Forewing*.—Pale watery green, semitransparent, costal edge cream-color; base narrowly moss-green; at apex and anal angle a round patch of red-brown and rosy-gray scales surrounded by a ring of moss-green, that at apex much the larger; cell spot minute; an obscure vertical darker green antemedian shade and an angulated postmedian with paler edge; fringe pale green, rosy beyond the patches.

*Hindwing*.—The same, but the apical patch smaller and with an additional small patch on inner margin before middle.

Under side pale iridescent green, with the patches showing through; costa of forewing yellow.

Face and palpi red; vertex and antennæ white; thorax and dorsum red-brown varied with dark scales; the tufts metallic; abdomen at sides and beneath and the whole of the last two segments ochreous; pectus and legs ochreous.

*Expanse of wings*.—Male, 40 mm.

*Locality*.—St. Jean, Maroni, French Guiana.

The colored patches can really be best compared with the unopened flowers of a moss-rose.

*Type*.—Cat. No. 9194, U.S.N.M.

**RACHEOLOPHA LILACINA, new species.**

*Forewing*.—Dull green, semitransparent; the costa yellow, beyond middle speckled with lilac; the inner and hind margin broadly lilac, the green ground-color being, in fact, restricted to a narrow subcostal stripe, which in the middle forms a deep sinus toward hind margin, embracing veins 3 and 4, and at base reaches inner margin, where it is edged by an oblique deeper lilac shade; fringe dark lilac checkered with white between the veins.

*Hindwing*.—Broadly green at base, the marginal half lilac, interrupted internally between veins 2 and 5 by a tridentate sinus of the ground-color; inner margin with a lilac patch at base; discocellular marked at top and middle by white spots; fringe as in forewing. In both wings the lilac area is varied with transverse white striæ, densest at anal angle of hindwings.

Under side pale iridescent green; the fringe and slight blotch at anal angle of forewings deep lilac; costa of forewing yellow.

Shoulders, thorax, and dorsum green; face, palpi, patagia, crests of the dorsum, and metathorax metallic lilac; abdomen beneath and at sides and the legs pale ochreous; forelegs in front deep lilac; anal tuft ochreous, mixed with lilac.

*Expanse of wings*.—Male, 36 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Distinguished from *O. violacea* Warren by its larger size, speckled costa, and better defined marginal borders,

*Type*.—Cat. No. 9195, U.S.N.M.

**RACHEOLOPHA LONGIPALPIS, new species.**

*Forewing*.—Grass-green, covered with faint brownish striæ; cell spot blackish, minute; a dull red-brown marginal border, thickly black speckled; its inner edge is lunulate between the veins; oblique from apex to vein 6; then parallel to margin to vein 3, along which it runs backwards and again oblique to inner margin at three-fifths; fringe red-brown.

*Hindwing*.—With the margin occupying quite half the wing, its inner edge starting from three-fifths of costa and ending at two-fifths of inner margin, with a subquadrate sinus between veins 2 and 6.

Under side of forewing suffused with vinous except along costa and inner margin, the marginal border black, vinous at apex; fringe black, with the basal line red; costal edge yellow; hindwing with the black border submarginal, edged with vinous; the basal submarginal areas pale green.

Palpi very long, deep red above, pale green below; face olive; vertex white; antennæ reddish; thorax and dorsum green, the tufts metallic dark red; abdomen beneath whitish green, with a short red lateral stripe.

*Expanse of wings*.—Female, 46 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Forewings subfalcate; hindwings sinuous.

*Type*.—Cat. No. 9196, U.S.N.M.

**RACHEOLOPHA NIVETACTA, new species.**

*Forewing*.—Deep green, striated in places with whitish, the disk beyond cell between veins 2 and 6 white with olive striæ; cell spot large, dark fuscous; costal area above subcostal vein ferruginous speckled with blackish; large white marginal spots at the ends of the veins running into the yellowish green fringe.

*Hindwing*.—Similar, the white discal space reaching to base and occupying the whole wing except the margins; cell spot smaller.

Under side iridescent whitish green; the fringe the same; costa of forewing ferruginous; vertex, antennæ, face, palpi, and front of fore-

legs ferruginous; thorax and dorsum green; the crests of the latter metallic brown; abdomen beneath and legs cream-white.

*Expanse of wings*.—Male, 30 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

*Type*.—Cat. No. 9197, U.S.N.M.

**RACHEOLOPHA PALLIDA**, new species.

*Forewing*.—Very pale green, almost white, without markings, except a small dark green cell spot; fringe rosy red.

*Hindwing*.—The same.

Under side whitish.

Face, palpi, deep red; vertex and antennal shaft snow-white; thorax and abdomen whitish green; abdomen with five red dorsal tufts, the first three larger.

*Expanse of wings*.—36 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, August, 1904.

*Type*.—Cat. No. 9198, U.S.N.M.

**RACHEOLOPHA SPORADATA**, new species.

*Forewing*.—Milk-white, sprinkled with rounded spots of pale green, irregularly confluent, and suffused in middle to form an oblique, somewhat club-shaped streak from top of discocellular to anal angle; a narrow border along hind margin of irregular confluent green blotches, marked with deeper green dashes on margin between the veins and interrupted by large white spots at their ends; fringe white, checkered with green between veins; veins, especially at base, dark green.

*Hindwing*.—Similar, the central streak more broken up and the marginal border narrow; costal area without green spots.

Under side iridescent whitish, the darker green markings showing through.

Face green, white below; palpi red above, white below; vertex and shoulders white; patagia, thorax, and two basal segments of abdomen green; rest of abdomen white flecked with green; dorsal crest metallic chocolate, tufted with white hairs; anal segment and under side of abdomen and the legs white; forelegs brown in front.

*Expanse of wings*.—Male, 40 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

*Type*.—Cat. No. 9199, U.S.N.M.

Genus **TACHYPHYLE** Butler.

**TACHYPHYLE COSTISCRIPTA**, new species.

*Forewing*.—Delicate pale green; costa ochreous, thickly striated with fuscous and black; the lines olive, indistinct; first from two-fifths of costa, above the black cell spot, oblique inward, angled baseward

on the two folds and outward on the median vein; second from a gray cloud at two-thirds, sinuous, curved outward above and inward below median, to three-fourths of inner margin; fringe pale green.

*Hindwing*.—With only a median olive line just beyond the black cell spot.

Under side whitish green, the costa of forewing yellowish.

Face and palpi greenish; vertex white; thorax and base of abdomen green, the rest of abdomen ochreous.

*Expanse of wings*.—Male, 20 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Resembles *T. undilinea* Warren but smaller, the first line of forewing quite different; the hind tibiae of male have only terminal spurs, typically there are four.

*Type*.—Cat. No. 9200, U.S.N.M.

#### TACHYPHYLE SUBFULVATA, new species.

*Forewing*.—Pale green along costa and hind margin; the rest of the wing a confused mixture of dark greenish gray and dull rust-color; a dull blackish cell spot, preceded by an equally obscure curved inner line; outer line from two-thirds of inner margin, slightly curved, running parallel to hind margin but not reaching costa; costal edge narrowly white throughout; fringe whitish green.

*Hindwing*.—Narrowly green along hind margin only; all the rest of the wing invaded by the rusty gray tint, darkest across the middle where there is a dark cell spot followed by a thick straight postmedian line; costal area quite pale; fringe almost whitish.

Under side of forewing fulvous at base, pale olive-green beyond middle, becoming whitish green along hind margin; costa and fringe whitish green; inner margin broadly pale violet-gray; hindwing mainly fulvous, all the margins and fringe whitish green; an olive-green band before hind margin; cell spot lunular, dark green.

Face and antennae white; thorax and abdomen green and fulvous.

*Expanse of wings*.—30 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, March, 1904.

Nearest to *T. æretincta* Warren, from Peru.

*Type*.—Cat. No. 9201, U.S.N.M.

#### Subfamily STERRHINÆ.

#### Genus ANISODES Guenée.

#### ANISODES ABRUPTARIA, new species.

*Forewing*.—Very pale ochreous, dusted with fuscous-gray atoms, which are densest along costa; first line marked only by dark vein dots and dots on the two folds, at one-fifth, projecting outward in cell; cell

spot white, tinged with reddish; median shade thick, blurred gray, oblique from before middle of inner margin to vein 4 where it is angled and becomes obsolete above vein 5, preceded and followed above 4 by reddish scales; outer line at five-sixths, marked below costa by three dark dots on veins and at inner margin by a narrow gray streak, followed immediately by a pale submarginal line which is scarcely traceable; a large dark gray triangular blotch on hind margin between veins 4 and 6, mixed with red scales, connected with median shade at the angle; marginal striae dark, containing small spots between veins; fringe concolorous.

*Hindwing*.—With a dark spot at base; a gray band at one-fourth, with well defined darker edges; cell spot as in forewing; outer line marked by dark dots on veins above vein 4 followed throughout by a gray shade which is broad at inner margin and is connected below middle with a broad fuscous-gray shade reaching from anal angle to vein 5; marginal line crenulate, blackish.

Under side pale ochreous, unspeckled, except along costa of forewing; median shade bent, thick, and diffuse; outer line marked by dark spots on veins and followed by a reddish thick line swollen into a blotch beyond cell; a dark marginal line; in the hindwing only the outer thick line is marked.

Head, thorax, and abdomen like wings; face and palpi reddish above, ochreous below; vertex and antennal shaft whitish; abdomen with some lateral red markings.

*Expanse of wings*.—35 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, October, 1904; occurs also in southeastern Peru.

Hind margin of wings strongly crenulate, with a larger deeper sinus beyond cell. In appearance it bears a certain resemblance to a worn *Hemerophila abruptaria*.

*Type*.—Cat. No. 9202, U.S.N.M.

**ANISODES AURANTIATA variety ATRIDISCATA, new.**

Differs from the type form of *aurantiata* Warren only in the cell spots: these are large, round, black, with minute pale centers, that in the hindwing larger than that in the forewing.

*Locality*.—Carabaya, southeastern Peru; 1 male.

I have seen a female exactly corresponding with this male.

*Type*.—Cat. No. 9203, U.S.N.M.

**ANISODES DELINEATA, new species.**

*Forewing*.—Ochreous, covered with very fine gray and reddish striae, the gray ones thicker and stronger along costa; lines fine and black; first from costa close to base, oblique outward and forming a beak on median vein, then shortly oblique hindward, abruptly cut off

on submedian fold; median line oblique from costa before apex to one-third of inner margin, toothed outward at veins 6, 7; outer line from the same point on costa, sinuous parallel to hind margin, below vein 4 marked only by vein dots; a black concise streak from base along median vein and above vein 4 to hind margin, meeting there another along vein 5 passing through an angled mark beyond outer line; subcostal vein narrowly black from base to one-fourth; cell spot white in a thick red ring; marginal spots black; fringe concolorous.

*Hindwing*.—With a bifurcate black line near base and a black outer line bent on vein 5 from costa just before apex to three-fifths of inner margin; a black line along vein 4; the rest as in forewing, but the white cell spot is not tinged with red; in both wings a faint pale submarginal line is visible.

Under side pale ochreous with rosy striæ, which are more numerous in forewing, where the outer line alone is marked; marginal line fine in both wings.

Head, thorax, and abdomen like wings; tips of shoulders and collar finely black; face and palpi rosy above, pale below, legs ochreous, forelegs rosy in front.

*Expanse of wings*.—37 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, September, 1904.

The hind legs are abnormal; the tibia is quite short, as in *Brachycola* Warren from India, but without tufts and with short aborted spurs; the femur is twice as long as the tibia and the tarsus twice as long as the femur. Nearest to *A. hieroglyphica* Warren but quite distinct.

*Type*.—Cat. No. 9204, U.S.N.M.

#### ANISODES FLAVICORNIS, new species.

Closely allied to *A. ferruginata* Warren, from Colombia and *subænescens* Warren from Carabaya, southeastern Peru, and possibly an extreme form of this last species, as both come from the same locality.

Instead of the small white dot the cell marks are large and round, pure white, that in the hindwing twice as large as that in the forewing; the vertex and antennal shaft are bright yellow. In all other respects the description of *subænescens* applies to the present species.

*Expanse of wings*.—40 mm.

*Locality*.—Carabaya, southeastern Peru; 1 male.

*Type*.—Cat. No. 9205, U.S.N.M.

#### ANISODES FLAVIPUNCTA, new species.

*Forewing*.—Bone-color, covered with fine and dense brownish gray striations, thickest along costa and before hind margin; lines gray, marked chiefly by dark dots on veins; first from one-fifth of costa to one-fourth of inner margin, outcurved above and below median vein;

outer line obscurely lunulate-dentate, from four-fifths of costa to three-fourths of inner margin, more or less parallel to hind margin, projecting on veins 4 and 6; a thick olive-gray dentate median shade from three-fifths of costa to near middle of inner margin, also parallel to margin; cell spot linear, dark; blackish dots on margin between veins; fringe, bone-color.

*Hindwing*.—Similar, but the cell spot oval, deep yellow, ringed finely with dark.

Under side pale ochreous, without any gray striations; forewing with rosy median shade; some rosy striæ before it from base and a few before hind margin; outer and marginal spots rosy; hind wing without rosy striæ except at middle of costa.

Head, thorax, and abdomen like wings; face white, reddish brown at top; legs ochreous; forelegs and palpi rosy-tinged.

*Expanse of wings*.—36 mm.

*Locality*.—Rockstone, Essequibo, British Guiana; 1 female, September, 1904.

Probably near *A. suberea* Dognin; but the discal spots will distinguish it.

*Type*.—Cat. No. 9206, U.S.N.M.

#### ANISODES LEUCANIATA, new species.

*Forewing*.—Ochreous, covered with greenish gray speckling; cell spot oval, white, with gray edging; outer line marked only by dark vein dots; a row of marginal dark dots between veins; fringe pale; the base of wing is rubbed, but there is probably a series of basal dots on veins.

*Hindwing*.—With white cell spot, connected by a black spot with vein 6.

Under side pale ochreous, without markings.

Head, thorax, abdomen, and legs all concolorous; palpi above and forelegs in front slightly rosy.

*Expanse of wings*.—35 mm.

*Locality*.—Rockstone, Essequibo, British Guiana; 1 male, September, 1904.

The resemblance to species of *Leucania* will distinguish this insect at once. The apex of forewing is pointed; the hindwing slightly elbowed at vein 4.

*Type*.—Cat. No. 9207, U.S.N.M.

#### ANISODES POTRERIA, new species.

*Forewing*.—Reddish fawn-color, covered with very fine and obscure darker striæ; the inner and outer lines represented by minute dark dots on veins; the first curved near base, the outer at five-sixths; marginal dots between veins equally minute, with black points at the vein ends;

fringe concolorous, cell spot round and black, with a fine white center; a very faint median shade curved round this above, represented between veins 1 and 2 by a distinct reddish cloud.

*Hindwing*.—Similar, the cell spot larger.

Under side of forewing deep dull rosy, grayer along costa, of hindwing ochreous with costa only rosy; both wings with large, diffuse black cell spots.

Head, thorax, and abdomen like wings, the abdomen bright red on dorsum; face red; palpi red, paler beneath.

*Expanse of wings*.—26 mm.

*Locality*.—Jalapa, Mexico; 1 male.

*Type*.—Cat. No. 9208, U.S.N.M.

**ANISODES STRICTICATA, new species.**

*Forewing*.—Grayish fawn-color, with a faint reddish tinge in parts, and faintly dusted with darker; the first three lines all marked by blackish dots on veins; the basal line marked by dots on the folds as well as on the veins and on costa and inner margin also; the median and outer lines by minute black dots, the median dots being preceded by a hardly perceptible reddish shade; submarginal line indicated by series of black spots on each side, but placed between the veins, interrupted between 6 and 7 and 3 and 4, those beyond cell being the most conspicuous; marginal spots large and black between the veins, small and reddish at their ends; fringe paler; cell spot small, white, in a red ring.

*Hindwing*.—The same, but the cell spot rather larger, formed of black and red scales, with a minute pale point at center.

Under side dull rosy, paler in hindwing; costa of forewing ochreous-gray with black spots; cell spots, outer line, the inner of the two submarginal series, and the marginal line all marked darker in forewing; in the hindwing only the outer and marginal lines.

Head, thorax, and abdomen like wings; the dorsum flushed with red and with black marks on two basal segments; face pale brown.

*Expanse of wings*.—27 mm.

*Locality*.—Orizaba, Mexico; 1 male.

Resembles *A. nigropustulata* Warren from Brazil, but the ground color is different. Hind margins of both wings crenulate, slightly projecting at vein 4.

*Type*.—Cat. No. 9209, U.S.N.M.

**ANISODES SUBVIOLESCENS, new species.**

*Forewing*.—Pale sandy ochreous, without the brown or yellow tinge of *spissata* Warren, with which species it agrees in the markings in the main; the whole surface is finely powdered with darker atoms; costal edge not brown, as in *spissata*, the lines finer, not thickened into

shades, except the median, which is distinctly lunulate-dentate and decidedly more oblique than in *spissata*; outer line lunulate-dentate, the teeth marked by brown dots; submarginal shade forming dark blotches beyond cell and vein 2 before hind margin; cell spot hardly marked; the basal line curved inward toward inner margin; dark marginal spots between veins and reddish dots at their ends; fringe pale ochreous.

*Hindwing*.—With the cell spot white in a small dark ring; the marginal blotches faint.

Under side yellowish straw-color; forewing with cell, median shade, outer line, and three large submarginal blotches rosy, accompanied by rosy striæ; the dots of outer and marginal lines also rosy; hindwing with submarginal blotches only and these much smaller.

Head, thorax, and abdomen like wings; face whitish, reddish brown above; palpi above and forelegs in front rosy; legs and abdomen beneath ochreous.

*Expanse of wings*.—30 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, December, 1904.

Hind tibiæ of male with one median spur as well as the two terminal.

*Type*.—Cat. No. 9210, U.S.N.M.

#### ANISODES TERRENS, new species.

*Forewing*.—Dull reddish gray, darker gray without the reddish tinge along costa; basal and submarginal lines marked by black dots; marginal dots large and black; cell spot white, with black edge; fringe concolorous.

*Hindwing*.—Like forewing, but the cell spot is a large, coal-black disk with a minute pale center.

Under side uniform dull rosy, with the submarginal series of dots visible.

Head, thorax, and abdomen like wings; face dull brown-red; paler below, vertex and base of antennæ pale; palpi and forelegs dull rosy.

*Expanse of wings*.—26 mm.

*Locality*.—Jalapa, Mexico; 1 female.

Near to *A. subcarnearia* Warren, from Brazil, and, judging from the description, also to *aguzata* Dognin. Described from a male from Ecuador.

*Type*.—Cat. No. 9211, U.S.N.M.

#### Genus ASELLODES Guenée.

#### ASELLODES HEBETIOR, new species.

Very near *A. vitraria* Schaus, but rather smaller; the apex of forewing blunter; the hind margin straighter; the outer edge of the hyaline space of forewing nearer to hind margin and almost parallel to

it; the submarginal line between veins 6 and 3 straight, not formed of lunules between the veins, and narrower. In the hindwing the disposition of the hyaline spaces is almost identical with that of *vittraria*, but the hind margin is altogether different; for, whereas in *vittraria* veins 6, 7, 8 end in acute teeth, the ends of these veins in *hebetior* are bluntly rounded, the lowest lying between veins 6 and 5 rather than beyond vein 5 itself, and the margin insinuate before the anal lobe instead of straight. On the under side the dark submarginal band of the hindwing is straight, not waved.

*Expanse of wings*.—26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

*Type*.—Cat. No. 9212, U.S.N.M.

Genus APHANOPHLEPS, new genus.

*Forewing*.—Triangular; costa straight, becoming convex before apex; hind margin as long as inner margin, more oblique below middle than above.

*Hindwing*.—In female with hind margin well rounded, both angles distinct; in male with hind margin protuberant in middle and toward anal angle, which is rounded off; antennæ of male ciliated; palpi incurved before face, short; hindlegs in the type species with a long tuft of hairs from femero-tibial joint reaching to end of tarsus, both tibia and tarsus thickened with scales, without spurs; female with terminal spurs only.

*Neuration*.—Forewing, cell half the length of wing; discocellular straight, vertical; first median nervule at two-thirds, second at five-sixths; radials normal; 7, 8, 9, 10 stalked from before end, 11 free; no areole; hindwing; costal kinked near base to touch subcostal at a point; 6, 7 stalked; 3, 4 coincident in both sexes; in the female of one species broadly forked close before margin.

*Type*.—*Aphanophleps vulpina*, new species.

In the type species the outer two-thirds of the under side of hindwing in the male is roughly clothed with curved hairs throughout, and the abdominal margin is simple; in a second species the median vein and the two veinlets also are clothed with fringes of short hairs; the abdominal margin is swollen and the surface below covered with mealy scales, but the coincidence of the two upper median nervules is sufficient, at least for the present, to characterize the genus.

APHANOPHLEPS VINOSARIA, new species.

*Forewing*.—Ochreous, dusted and only in parts tinged with vinous-purple in the male; in the female wholly suffused with it except along costa; male, costa, cell spot, and the two lines purple; first line at about one-third, diffuse, vertical; outer line from two-thirds of costa,

thick, lunulate-dentate, outcurved above, indented on submedian fold; a hind marginal cloud, the marginal line and the fringe dark purplish.

*Hindwing*.—With the base, an antemedian shade, a fine postmedian line, the apex, and fringe vinous; cell spot vinous; the swollen flap on abdominal margin pale ochreous.

Under side brownish ochreous with the base and hind margin diffusely vinous; cell spot, outer line, and fringe deeper red; hindwing with only the cell spot and fringe vinous, the mealy scales in the submedian furrow brownish; the fringe of hair on median veins ochreous; in the female the vinous markings are dull but present on both wings.

Head and dorsum deep purple; shoulders and patagia ochreous, paler in the male; abdomen beneath and legs ochreous.

*Expanse of wings*.—16 mm.

*Locality*.—Cayenne, French Guiana; 1 male, 1 female, January and February, 1904.

*Type*.—Cat. No. 9213, U.S.N.M.

#### APHANOPHLEPS VULPINA, new species.

*Forewing*.—Male rufous-brown, becoming ochreous with rufous scaling along costal margin; a dark cell spot, and dark rufous outer line from four-fifths of costa outcurved and approaching hind margin below middle; inbent and angled on submedian fold; fringe dark rufous beyond a dark rufous marginal line.

*Hindwing*.—Wholly rufous, with an obscure fine outer line, bent on vein 3.

Under side brighter rufous; the costa of forewing only dull yellowish; the cell spot and outer line visible.

Head red; shoulders and patagia ochreous-brown like costa of forewings; abdomen, rufous; legs, ochreous; the tuft of hind legs deep rufous.

*Expanse of wings*.—20 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

*Type*.—Cat. No. 9214, U.S.N.M.

The female may be described as follows:

*Forewing*.—Olive-ochreous, suffused throughout with dark purplish; costal margin, inner and outer line purplish; cell spot, marginal line, and basal half of fringe deep purple; first line nearly vertical, obscure at one-third; outer from three-fourths of costa outcurved and indented on submedian fold; the tips of fringe rufous.

*Hindwing*.—The same, but with no inner line.

Under side yellowish straw-color in forewing, suffused with reddish; both wings with cell spot, outer line, and fringes reddish.

Head red; thorax and abdomen like wings; abdomen below and legs ochreous.

*Expanse of wings.*—17 mm.

*Locality.*—Geldersland, Surinam River, Dutch Guiana; 1 female.

In the hindwings of the female the coincident veins, 3, 4, are widely forked just before hind margin.

Genus CREMODES Guenée.

CREMODES CONCOMITANS, new species.

*Forewing.*—Pale stone-color, dusted with gray; the costal edge ochreous; the lines fine, gray, parallel to hind margin; first at one-fourth, second from two-thirds of costa to near middle of inner margin, faintly outcurved from costa to median third at five-sixths, irregularly crenulate, bent above veins 6 and 2; beyond the second line is a faint thick gray shade parallel to it; cell spot white in a black ring; marginal line fine, interrupted at veins; fringe concolorous; in the male with a pink tinge.

*Hindwing.*—Without inner line; fringe with slight dots beyond veins.

Under side paler, more ochreous; the costa of forewing pinkish; the outer line only plain.

Palpi externally red-brown, ochreous beneath; face gray-brown; vertex, thorax, and abdomen like wings; tufts of hair of hind tibiae of male pale ochreous.

*Expanse of wings.*—34 mm.

*Locality.*—Santiago, Cuba; 1 male, 1 female, June and October, 1902.

*Type.*—Cat. No. 9215, U.S.N.M.

CREMODES CURTA, new species.

*Forewing.*—Pale grayish ochreous towards base, becoming deeper, more mouse-color in outer half, with a faint rufous tinge; the lines gray, indistinct; first slightly outcurved at one-fourth; median from costa just beyond middle to middle of inner margin, incurved from vein 5 to 2, followed by a broader parallel shade; outer line at three-fourths, irregularly projecting between 2 and 4, and indented beyond cell; a fine dark marginal line; fringe rufous; cell spot small, blackish.

*Hindwing.*—Without basal line.

Under side paler, the inner margin of forewing whitish; costa of forewing rufous, only the outer line distinct and thickened; the hind margin gray without any rufous tinge.

Thorax and abdomen like wings; face and vertex darker; palpi white beneath, externally dark brown.

*Expanse of wings.*—30 mm.

*Locality.*—Santiago, Cuba; 1 female, October, 1902.

Characterized by the short, blunt wings, and the red fringe.

*Type.*—Cat. No. 9216, U.S.N.M.

**CREMODES FUSCIFRONS, new species.**

*Forewing*.—Pale stone-color, with very fine gray dusting; crossed by three faintly darker lines, more or less parallel to hinder margin; the inner at one-third, before the small black cell spot; the second from three-fourths of costa to just beyond middle of inner margin; the third at five-sixths, these last irregularly dentate; the teeth gray; a fine marginal line interrupted at the veins; fringe gray with a slight pink tinge.

*Hindwing*.—Without inner line; the cell spot round with a white center; the fringe with reddish spots in it beyond the veins.

Under side paler with a faint pink tinge in forewing; the costa pinkish, only the outermost line visible; inner margin and hindwing throughout ochreous in tint.

Palpi above dark brown, pale ochreous beneath; face and vertex brown; thorax and abdomen like wings.

*Expanse of wings*.—38 mm.

*Locality*.—Baracoa, Cuba; 1 male, October, 1902.

Differs from *C. costaria* Guenée from Santo Domingo in not having a white vertex.

*Type*.—Cat. No. 9217, U.S.N.M.

**Genus CRYPSITYLA Warren.****CRYPSITYLA BORRIGARIA, new species.**

Differs from *C. turbata* Walker only in the forewing being narrower and with more pointed apex, and in the absence of the dull yellow scales beyond each of the dark lines; the ground color is dull purplish gray; the costal area of forewing dull vinous.

*Localities*.—Orizaba, Mexico; 1 male; Jalapa, Mexico, 3 females.

*Type*.—Cat. No. 9218, U.S.N.M.

**CRYPSITYLA IGNIFERA, new species.**

*Forewing*.—Deep coppery red, with costa pale olive-ochreous, and the lines yellowish; these are placed much as in the allied species, but are complete, not interrupted, the outer and submarginal lines being plainer than the rest; fringe concolorous, with large yellowish spots at the base.

*Hindwing*.—The same, with the outer lines only.

Under side yellowish ochreous, tinged with rosy in costal half of forewing, more rosy throughout in the female.

Head red; shoulders and patagia like costal streak of forewing; dorsum ochreous tinged with red, especially in the female.

*Expanse of wings*.—19 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 3 males, 1 female, March, 1904.

*Type*.—Cat. No. 9219, U.S.N.M.

**CRYPsITYLA SUBROSEA** Warren.

This species was described from 2 males from Colombia: a female from São Paulo, southeast Brazil, appears to be inseparable; but the hind tibiae have only terminal spurs, as in *Sterrha*, and not a vestige of the single median spur, characteristic of the females of *Crypsityla* and *Calyptocome*. I have met with more than one instance of similar absence of the single median spur in other species of these genera, and attributed it in each case to accidental breakage; but it seems probable that such cases are rather due to a further extension to both middle spurs of the already existing tendency in the genera to atrophy of the one, the females in these instances suggesting a species of *Sterrha*.

**CRYPsITYLA SUBRUBELLA**, new species.

*Forewing*.—Deep purplish plum-color; the costa broadly and all the lines more narrowly and neatly than in *pannaria* Guenée, olive-ochreous, without any vestige of dark edging; the fringe similarly darker.

*Hindwing*.—Similar.

Under side of both wings uniform deep rosy; the tuft of hair on costa of hindwing and the mealy scales between vein 1 and the median yellowish.

Head and dorsum deep purple; shoulders, patagia, thorax, and a line along middle of dorsum olive-ochreous; under side of abdomen and legs ochreous; forelegs deep rosy in front.

*Expanse of wings*.—19 mm.

*Localities*.—St. Jean, Maroni River; 1 male, July, 1904; Cayenne, French Guiana, 3 males, February, 1904, and December, 1903.

Distinguished by the deep red under side of both wings.

*Type*.—Cat. No. 9221, U.S.N.M.

**CRYPsITYLA TURBATA** Walker.

This species appears to be widely spread and variable to some extent, according to locality. Of three examples from Orizaba, 1 male, 1 female have the brown markings simple; the other female has the pale edging, while 2 males from Guadalajara both show the yellow markings clearly. Two females from Castro, Parana, and 1 female from São Paulo vary in a similar way. I have seen a female from Merida, Venezuela. Walker's type was from Brazil.

All the examples seen agree in having the median shade肘ed and swollen across veins 2 and 3 and the pale fringe with orange-red speckling in the basal half.

One female from Orizaba, Mexico, is wholly deep purple in both wings, with the lines where visible deeper; the abdomen like the wings, but the prothorax and base of costa olive-ochreous. The under

side of forewings is proportionally deeper in first than the usual forms. For this I propose the varietal name *purpurata*, new variety.

Genus DEINOPYGIA Warren.

DEINOPYGIA CONIFER, new species.

*Forewing*.—Male, pointed, hind margin oblique; bone-color, tinged with ochreous-gray; costa with two dark spots at one-third and two-thirds, but, as in the other species, the lines starting from them are interrupted above middle; the first is curved as usual, the outer slightly outcurved below costa, runs obliquely inward, marked by reddish spots on veins to inner margin near inner line; the band thus formed, which is filled in with reddish scales below, is, therefore, much narrower than in *triangulata*; submarginal line pale, unspeckled; cell spot large and dark; fringe concolorous, with dark dots at base.

*Hindwing*.—With hind margin rounded, with slight indentation beyond submedian fold, the red-brown band forming a large cone-shaped mark on inner margin reaching vein 6; some red-brown scales on margin at the indentation on submedian fold; submarginal line pale.

Under side ochreous, with coarse red-brown scales and in forewing tinged with olive-gray; the spots and outer lines red-brown.

Face, palpi, and front of forelegs dark brown; vertex, thorax, and abdomen ochreous; middle segments of abdomen red-brown; anal segment not extraordinarily long, but the anal tufts largely developed.

I believe the following female to belong to the males above described; but more specimens are needed for corroboration.

*Forewing*.—Female, wholly suffused with olive-gray, all the markings more or less hidden, except the two dark costal spots and the cell spot.

*Hindwing*.—With the black band narrow on inner margin and broadening toward cell; the whole wing with blackish atoms; hind margin protuberant in middle, insinuate before anal angle, which is well marked.

Under side with the cell spots large and black; the band of hindwings black and also an outer line on forewings.

Thorax and abdomen ochreous, the latter not blotched with black at middle.

*Expanse of wings*.—16 mm.

*Locality*.—Cayenne, French Guiana; 3 males, 1 female, January and February, 1904.

*Type*.—Cat. No. 9223, U.S.N.M.

DEINOPYGIA FALCIPENNIS, new species.

Distinguished from *D. caudata* and all other species of the genus by the narrow elongate forewings with falcate apex, and the deeply incised hind margin of hindwings.

*Forewing*.—Ochreous, dusted with blackish; a blackish curved basal line projecting on median vein; a dark oblique fascia from inner margin beyond middle parallel to hind margin, but apparently not extending above middle of wing, though marked by a spot on costa. The unique specimen is so much rubbed toward apex of forewing that further description is impossible.

*Hindwing*.—With a blackish band across middle, preceded and followed by some brown dusting; below vein 5 a deep incision runs inward for one-third, vein 4 ending at its extremity, the lower part of wing forming a long spatulate lobe.

Under side pale brownish ochreous, with the fringes of hairs in both wings of the same color; the black markings of upper side repeated.

Thorax and abdomen ochreous, the dorsum with blackish scaling; vertex white; face and palpi black; tips of the preanal tufts black.

*Expanse of wings*.—17 mm.

*Locality*.—Orizaba, Mexico; 1 male.

This species possesses a very long expansive pencil of hairs rising from the base of costa of hindwings.

*Type*.—Cat. No. 9224, U.S.N.M.

#### DEINOPYGIA HORRIFICA, new species.

*Forewing*.—Dull brownish ochreous, roughly dark speckled, with obscure traces of dark lines, inner, median, and outer, the last plainer than the others; marginal dashes dark between the veins; fringe rather darker; a blackish cell spot.

*Hindwing*.—Pale toward base; the marginal areas clothed with a mass of scrubby brown and ochreous hairs.

Under side dull brownish ochreous, both wings covered with downy hairs; cell spot and outer line of forewing dark, and a tuft of dark hairs at middle of inner margin; hindwing marked with blackish along hind margin.

Head and shoulders pale brown; face, thorax, and dorsum dark brown.

*Expanse of wings*.—16 mm.

*Locality*.—Cayenne, French Guiana; 1 male, February, 1904.

The anal lobe of hindwing is more produced than in *D. caudata* Warren.

*Type*.—Cat. No. 9225, U.S.N.M.

#### DEINOPYGIA PERCURRENS, new species.

*Forewing*.—Ochreous in basal half; flesh-colored in marginal; the two shades separated by a brown bar, gradually narrowing from inner margin at middle to costa beyond middle, with darker edges and followed by a pale line; the basal ochreous area is somewhat olive tinged

and dusted with dark scales, with traces of a dark costal spot at one-fourth; in the marginal area at anal angle is a slight brownish cloud; fringe ochreous, with large blackish dots at base beyond the veins.

*Hindwing*.—Similar, but the brown band is broadest below costa, where it is angled outwardly and narrows to inner margin; the apex with a large dark cloud; fringe as in forewing.

Under side of forewing dull bronzy reddish, of hindwing more fuscous.

Vertex, thorax, and abdomen ochreous; face and palpi red.

*Expanse of wings*.—15 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, April, 1904.

Probably, but by no means certainly, a *Deinopygia*.

*Type*.—Cat. No. 9226, U.S.N.M.

#### DEINOPYGIA TRIANGULATA, new species.

*Forewing*.—Male, pale buff, slightly gray speckled; two dark red costal spots at one-third and two-thirds; from the first a curved inner line runs, interrupted above median vein; from the second an irregular outer line, partially lunulate-dentate and projecting squarely between veins 3 and 4; the space between them filled up with red-brown as far as vein 6, often partially interrupted along inner edge, the small cell spot lying on the outer edge; this line is paler edged; submarginal line pale, unspeckled; marginal dots deep red; fringe concolorous.

*Hindwing*.—Without speckling; a red-brown band from vein 6 to inner margin, wider below the red-brown cell spot beyond its outer edge; marginal dots large; fringe concolorous, but darker at anal angle.

Under side ochreous; in the forewing flushed with reddish; cell spots and outer lines black-red; the hair tufts somewhat yellower.

Vertex, thorax, and abdomen ochreous speckled with red-brown; collar, face, and palpi dark red-brown; lateral preanal tufts reddish at base.

Female hardly distinguishable from that of *D. caudata* Warren; the bands on both wings appear to be broader and more developed.

*Expanse of wings*.—17 mm.

The male differs from typical *Deinopygia* in having the forewing broader, the hind margin of the same length as inner margin, straight and vertical; the hindwing is not indented except at submedian fold, forming only a short anal lobe.

*Locality*.—Cayenne, French Guiana; 3 males, 3 females, January and February, 1904.

*Type*.—Cat. No. 9227, U.S.N.M.

## Genus DICHROMATOPODIA Warren.

## DICHROMATOPODIA CERVINA, new species.

*Forewing*.—Reddish fawn-color, dusted in places with fine black scales, especially in the marginal area; lines fine, pale ochreous, the first edged outwardly, the outer inwardly, with an olive-gray line; first from one-fourth of costa to one-third of inner margin; angled on subcostal vein, then inwardly oblique; outer from three-fourths of costa, below which it is curved, to two-thirds of inner margin; cell spot linear, white; marginal line finely dark, interrupted at veins; fringe concolorous, with pale basal line.

*Hindwing*.—With outer line only, slightly curved toward costa.

Under side pale pinkish ochreous, more pink in forewing; outer line only marked; fringe red, as above; cell spot of forewing only visible.

Head and thorax like wings; abdomen paler, like the under side and legs.

*Expanse of wings*.—25 mm.

*Locality*.—Aroa, Venezuela; 1 male.

*Type*.—Cat. No. 9228, U.S.N.M.

## DICHROMATOPODIA PURPUREA, new species.

*Forewing*.—Dark grayish purple; the costal edge with some red scales on an olive-yellow ground; lines fine, olive-yellow, broadening at costa; first from one-fourth of costa to one-third of inner margin, angled on subcostal vein; outer from two-thirds of costa to two-thirds of inner margin, bluntly bent at vein 6; fringe pale; an oblique linear mark of white scales on discocellular.

*Hindwing*.—With outer line only, nearly straight; cell spot as in forewing.

Under side dull liver-color, with the outer line darker; costa of forewing paler.

Head, thorax, and abdomen purple; abdomen beneath and legs ochreous; forelegs purple in front; antennæ ochreous.

*Expanse of wings*.—26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male; July, 1904.

Nearest to *D. munata* Druce, described as an *Anisodes*.

*Type*.—Cat. No. 9229, U.S.N.M.

## DICHROMATOPODIA RUFIMEDIA, new species.

*Forewing*.—Dull red-brown, with black dusting in basal and marginal areas, paler dusted with brick-red in the median; lines finely pale; first from one-fourth of costa, angled on subcostal vein, then vertical to one-third of inner margin, edged outwardly with a brick-

red line; outer line from three-fourths of costa, curved parallel to hind margin, to two-thirds of inner margin, inwardly edged with brick-red; cell spot oval, black, with a slight gray center; marginal line thick, interrupted by pale dots at the veins; fringe concolorous.

*Hindwing*.—Like forewing, but the whole basal two-thirds brick-red; outer line curved; cell spot smaller.

Under side deep dull rosy, paler in hindwing; outer lines indicated; cell spots blackish; inner margin of forewing whitish.

Head, thorax, and abdomen dull red-brown, under side and legs ochreous.

*Expanse of wings*.—24 mm.

*Locality*.—Cayenne, French Guiana; 1 male, June, 1904.

*Type*.—Cat. No. 9230, U.S.N.M.

#### Genus DYSEPHYRA Warren.

##### DYSEPHYRA ALBIDISCATA, new species.

*Forewing*.—Brownish testaceous, powdered with fine dark atoms; the lines gray, thick and diffuse; first at one-third, waved and vertical below cell; outer and submarginal dentate-lunulate, parallel to each other, incurved below middle and insinuate beyond cell and on submedian fold; cell spot white, in a brown ring; fringe concolorous.

*Hindwing*.—Without inner line; the cell spot rather longer.

Under side paler, rufous yellow, more yellow toward base; the lines and cell spots faint.

Thorax and abdomen like wings; face and vertex reddish brown; palpi beneath whitish.

*Expanse of wings*.—40 mm.

*Locality*.—Cayenne, French Guiana; 3 males, December, 1903, February, 1904.

*Type*.—Cat. No. 9231, U.S.N.M.

##### DYSEPHYRA ALBIDISCATA variety NIGRIDISCATA, new.

The aberration *nigridiscata* has the cell marks filled up with gray and the brown ring thicker; the coloration slightly darker and browner.

*Localities*.—Cayenne, French Guiana, 1 male, January, 1904; St. Jean, Maroni River, French Guiana, 2 males, July, 1904; in these two examples the cell marks are larger.

*Type*.—Cat. No. 9830, U.S.N.M.

#### Genus EMMILTIS Hübner.

##### EMMILTIS BLANDULA, new species.

*Forewing*.—Chalk-white, with a few coarse black scales near base only; inner, outer, and marginal lines marked by black spots, the two former on the veins, the latter between them; median and submarginal

lines faint, ochreous-gray; cell spot black, distinct; tooth on vein 6 of outer line acute and prominent; fringe white, with gray dots at middle beyond veins.

*Hindwing*.—Without first line.

Under side white; in forewing toward costa dull ochreous-gray.

Face and palpi brown-black; vertex and thorax white; abdomen broken.

*Expanse of wings*.—14 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

*Type*.—Cat. No. 9232, U.S.N.M.

**EMMILTIS OMISSA, new species.**

*Forewing*.—Bone-color with a grayish tinge and dusted with darker, especially at base and along costa; lines pale brownish ochreous, all oblique, parallel to the oblique hind margin; the basal angled in cell, the median and outer on vein 6; the median thick and obscurely dentate from two-thirds of costa to before middle of inner margin, the outer fine and near hind margin; the submarginal lines very fine; cell spot black, large; marginal dots black, small; fringe concolorous.

*Hindwing*.—Without inner line; cell spot large, just beyond median shade.

Under side of hindwing and inner margin of forewing whitish; rest of forewing gray tinged, darker in basal two-thirds; outer line marked in forewing; cell spots in both.

Face, collar, and palpi black-brown; vertex white; thorax and abdomen like wings; segmental rings paler.

*Expanse of wings*.—30 mm.

*Locality*.—Bolivia; 1 male.

*Type*.—Cat. No. 9233, U.S.N.M.

**EMMILTIS TRICINCTA, new species.**

*Forewing*.—Chalk-white, with scattered oblique gray scales; the lines olive-gray, all in the main parallel to hind margin; the first very fine from one-fifth of costa to one-fourth of inner margin, outcurved in cell, then oblique inward; median shade beyond middle, thick, dentate, the outward teeth lightly black marked on veins; outer line sharply dentate, the outward teeth black on veins, followed immediately by the inner of the two submarginal lines; both of these lines show the tooth on vein 6 acute and projecting; outer submarginal line close to margin, indefinite; a marginal line of black crescents; fringe white, with a middle line of black atoms; no cell spot visible.

*Hindwing*.—Without first line; a small cell spot outside a curve in the median line, the three outer lines equidistant.

Under side white, with a gray tinge in forewing.

Thorax and abdomen white, like wings; face, vertex and palpi, and forelegs in front dark brown.

*Expanse of wings*.—22 mm.

*Locality*.—Castro, Parana, Brazil; 1 female.

Very close to *E. unicornuata* Warren, also from Brazil.

*Type*.—Cat. No. 9234, U.S.N.M.

Genus EUMACRODES Warren.

EUMACRODES EXCILINEA, new species.

*Forewing*.—Pale gray, speckled with darker; lines very fine; first from one-fifth of costa to one-fourth of inner margin, marked by a dark spot on costa and submedian vein; median line from three-fifths of costa, oblique outwards to vein 6, then straight and oblique inward, marked black on costa and subcostal vein, gray below; an intermediate fine line is visible between these two, nearer the inner line; outer line marked by black vein dots, from four-fifths of costa to three-fourths of inner margin; marginal area darker gray, with distinct pale wavy submarginal line; marginal line black, interrupted by the veins; cell spot small, black; fringe gray, checkered with darker.

*Hindwing*.—With the lines very ill-defined; marginal area darker; cell spot small.

Under side dark gray; the lines indicated.

Head, thorax, and abdomen like wings above; face dark brown.

*Expanse of wings*.—16 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

Smaller and darker than *E. gracilis* Warren, the lines differently placed.

*Type*.—Cat. No. 9235, U.S.N.M.

Genus HÆMALEA Hübner.

HÆMALEA COMMUNITA, new species.

*Forewing*.—Pearly cream-color, sprinkled with fine black atoms; costa purplish black; lines dark ferruginous; first obscure, at one-fourth, incurved below median; median at three-fifths, gently curved outward above and below median, and incurved on submedian fold; cell spot annular, ferruginous, with a blackish dot in middle, touching median line at 4; outer line from quite three-fourths of costa, nearly straight but with slight thickenings at the veins toward hind margin at vein 1, before which it is bent inward at right angles and again on submedian fold to inner margin, followed closely by an interrupted line of brown lunules with blackish tips, an irregular one above vein 6, a complete one below 4, and a double one on submedian fold being conspicuous; an iron-gray marginal shade from vein 7 to anal angle;

a marginal series of black-brown dashes, those below costa confluent; fringe rufous, with purplish base.

*Hindwing*.—With simple black cell spot preceded by a ferruginous antemedian line, outer line more sinuous than the forewing; the iron-gray marginal shade most distinct at apex, and the brown lunules toward anal angle.

Under side pearly white, the forewing, except along inner margin, suffused with purplish gray, deepening along costa and hind margin; cell spot and outer line thick and dark; fringe rufous; hindwing with a dark purplish cloud only along apex, narrowing to anal angle; cell spot and outer line faintly marked; fringe rufous with pale base.

Face, palpi externally, and shoulders blackish purple; collar dark brown; vertex and base of antennæ white; thorax and abdomen pearl-gray, the latter with dark segmental marks; fore and middle legs externally purplish fuscous.

*Expanse of wings*.—22 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

*Type*.—Cat. No. 9236, U.S.N.M.

**HÆMALEA FRAGMENTARIA, new species.**

*Forewing*.—Pearl-gray, speckled with dark ferruginous; costa blackish gray; the lines dark ferruginous, much as in *fervens* Butler; the basal line is incurved below median vein; median line bisinuate, the upper sinus touching the ferruginous cell spot; outer line less flexuous, only slightly bent above vein 6 and bluntly right-angled between 2 and 3; submarginal shade broken up into ferruginous lunular patches with slightly paler edging; marginal line thick, blackish; fringe gray and ferruginous.

*Hindwing*.—Without inner line; a slight dark marginal shade beyond submarginal line from apex to middle; this is also present, but less conspicuous, in the forewing.

Under side dull whitish, in forewing with a slight gray flush; costa, cell spot, outer and marginal lines fuscous; hindwing with only marginal line and shade.

Head and antennæ purplish; vertex and basal joint of antennæ white; collar and shoulders more reddish purple; thorax, patagia, and abdomen pearl-gray; segments of dorsum marked with gray and ferruginous.

*Expanse of wings*.—26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

Very near *fervens* Butler; distinguished by the breaking up of the submarginal band.

*Type*.—Cat. No. 9237, U.S.N.M.

**HÆMALEA VENIPUNCTATA**, new species.

*Forewing*.—Pearl-gray, dusted with gray atoms; the costa purplish black; the lines dark gray, indistinct; first from one-fourth of costa to one-third of inner margin, curved, inbent on submedian fold, marked by dark dots on veins and on the folds; median just beyond middle, vertical and waved, well beyond the purplish cell spot; outer line from three-fourths of costa to close before anal angle, projecting on veins 6 and below 4, insinuate beyond cell and on submedian fold, and marked by dark vein spots; submarginal line represented by dark wedge-shaped marks between veins, distinct only below costa and at anal angle; a dark gray marginal shade, projecting beyond cell; a marginal row of purplish black lunules; fringe rufous-gray, darker at base.

*Hindwing*.—Without first line; the submarginal line hardly marked, and the gray cloud apical only.

Under side pale pearly ochreous, tinged slightly with purplish in forewing, where the costa and hind margin are purplish gray; cell spot and outer line marked; hindwing with a slight apical shade.

Face and shoulders purple-black; vertex and base of antennæ white; thorax and abdomen white speckled with black; forelegs in front purplish.

*Expanse of wings*.—22 mm.

*Locality*.—Rockstone, Essequibo, British Guiana; 1 male, September, 1904.

*Type*.—Cat. No. 9238, U.S.N.M.

**Genus HEMIPTERODES**, new genus.

*Forewing*.—Elongate; costa straight, convex before apex; hind margin straight, oblique, curved only before anal angle.

*Hindwing*.—Squarely bent at apex; hind margin and inner margin quite straight, meeting at an acute angle, the wing appearing aborted; submedian fold below with a ridge of hairs, thickened toward anal angle, which is slightly contorted. Antennæ of female with long cilia-tions; palpi thick, well developed; third segment short; fore and middle legs strongly developed; hind legs aborted.

*Neuration*.—Veins 6, 7 of hindwings stalked; 3, 4 also stalked; cells of both wings broad; in forewing veins 2, 3, 4 rise near together, vein 5 from above middle of discocellular; 7, 8, 9, stalked; 10 anastomoses with 11 and again with 8, 9.

*Type*.—*Hemipterodes subnigrata*, new species.

The genus is related to *Lipomelia*.

**HEMIPTERODES SUBNIGRATA**, new species.

*Forewing*.—Bone-color, suffused with pinkish gray, and thickly dusted with dark atoms; an inner dark line from one-fourth of costa to one-fifth of inner margin, straight; an oblique purplish line straight

from middle of costa to one-third of inner margin, the space between these two lines is speckled except along costa; a small patch of ground-color appears also on inner margin beyond second line; cell spot linear, white, touching second line; submarginal line near margin, purplish, finely crenulate; a fine dark marginal line; fringe yellow, with pinkish gray checkering beyond veins.

*Hindwing*.—With inner half bone-color speckled with dark; outer half gray, becoming paler again along margin; cell spot white, touching a fine faint line, submarginal line shown only by dots on veins; marginal line and fringe as in forewing.

Under side straw-color; both wings with broad black and marginal border, which in forewing extends to middle; costa of forewing and marginal area reddish.

Vertex, thorax, and abdomen ochreous and gray; face, palpi, and forelegs red-brown; abdomen beneath and legs straw-colored.

*Expanse of wings*.—25 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; October, 1904; 1 male.

*Type*.—Cat. No. 9239, U.S.N.M.

#### Genus HETEREPHYRA Warren.

##### HETEREPHYRA AURATA, new species.

*Forewing*.—Pale yellow; the lines brownish gray; zigzag and irregular; first oblique outward from one-fifth of costa to one-third of inner margin, projecting above median; median line from three-fourths of costa, irregularly oblique and angled inward, to two-thirds of inner margin, its lower third, from near rise of vein 2, straight and parallel to inner line; from base to this line a gray costal cloud obscures the markings above the median vein; outer line irregularly zigzag, from five-sixths of costa to five-sixths of inner margin, sharply angled on vein 6; submarginal line thick, concave from below apex to hind margin at vein 4, then strongly lunulate-dentate to anal angle, nearly touching outer line; veins and marginal line gray; fringe yellow; cell spot narrow, white.

*Hindwing*.—Like forewing, but without the costal cloud and basal line; the three outer lines all irregularly zigzag; veins and marginal line brown.

Under side pale yellow, with all the markings indistinct and blurred.

Head, collar, and prothorax olive-gray like the costal cloud of forewing; rest of thorax and abdomen yellow, sprinkled with gray.

*Expanse of wings*.—25 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

*Type*.—Cat. No. 9240, U.S.N.M.

**HETEREPHYRA FULVESCENS, new species.**

*Forewing*.—Ground color yellow, covered with orange-red scales; costa blackish in basal half; the three median nervules gray; lines brown-red; first from one-fourth of costa to one-third of inner margin, elbowed on median vein; outer line, acutely dentate-lunulate; from three-fourths of costa to five-sixths of inner margin, the angles on veins 6 and 4 prominent; median line just beyond middle, oblique to 6, then vertical to 4; thence concave to inner margin; cell mark linear; along the discocellular; submarginal line thick, concave from seven-eighths of costa to hind margin at vein 4, reappearing as a blotch at anal angle; marginal line dark brown, interrupted by a yellow spot on the veins; fringe brownish fulvous; the space before median line below median vein is often darker.

*Hindwing*.—With all the veins gray and a gray shade before middle line, containing a single black cell spot.

Under side dull deep reddish, with the outer lines marked darker.

Head, thorax, and abdomen like wings, the abdomen grayer; face dark brown.

*Expanse of wings*.—22–24 mm.

*Locality*.—Cayenne, French Guiana; 3 females, January and February, 1904.

This species is near *H. lunifera* (*Dysephyra*) Warren<sup>a</sup>, also described from three females. The smaller female there referred to, from Cucuta, Venezuela, as having the second (median) line of forewings not denticulate, and only the upper of the two black discal spots of hindwings belongs to the present species.

*Type*.—Cat. No. 9241, U.S.N.M.

**HETEREPHYRA GRISEA, new species.**

Extremely like *H. punctata* Stoll, but rather larger, and altogether lacking the red tinge of that insect, the ground color being gray-fawn; the lines are the same in the main, but the inner and outer lines are much less deeply sinuate.

Under side similarly much paler. The abdomen and thorax gray.

*Locality*.—Trinidad, British West Indies; 1 female.

*Type*.—Cat. No. 9242, U.S.N.M.

**HETEREPHYRA SCRIPTURATA, new species.**

*Forewing*.—Olive-ochreous; the markings purplish brown; costa purplish; base with three thick transverse streaks from subcostal vein, oblique outwards, the third sinuous; cell spot ocelloid, formed by two thick oblique purplish streaks with the discocellular pale between them; median line outcurved round it above, below the middle parallel to the three basal streaks; outer line parallel to median, but

<sup>a</sup> Nov. Zool., IV (1897), p. 436.

the lower portion fine and concisely purple, edged narrowly with pale, submarginal shade parallel but swollen beyond cell; dark marginal lunules, those on each side of vein 3 pale; fringe purple-brown, with slightly pale base.

*Hindwing*.—Like forewing, but without the three basal lines; the whole inner marginal half thickly peppered with black to outer line.

Under side pale olive-buff; forewing with costa, cell spot, and median line dull purplish; outer line, marginal area, and fringes of both wings deep purple; apical area of forewing paler.

Head, thorax, and abdomen like wings; face, palpi, and forelegs dark purplish.

*Expanse of wings*.—30 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

*Type*.—Cat. No. 9243, U.S.N.M.

**HETEREPHYRA SEMIBRUNNEA, new species.**

*Forewing*.—Cream-color; the lines and shadings and the veins toward hind margin dark brown; costa diffusely dark brown; the lines all fine; an oblique line close to base, followed by a brown spot in cell; beyond this the usual basal line is strongly outcurved, running basewards toward costa and inner margin; outer line concisely lunulate-dentate from three-fourths of costa to a blotch at anal angle; the teeth on veins 6 and 4 especially projecting; it is preceded by three brown less concave shades parallel to it, before the innermost of which is the linear brown cell mark, occupying the whole length of the discocellular; the inner margin from basal line to the outer of the three shades is brown up to the submedian fold; submarginal line thick from seven-eighths of costa to middle of hind margin, blotched at both ends; marginal festoon brown; fringe cream-colored, mottled with brown.

*Hindwing*.—Suffused with brown, only the extreme base and a bilunate patch at anal angle remaining cream-color, the lines all present but obscured; cell mark formed by two black spots on, and at each end of discocellular; fringe brown, except beyond anal blotch.

Under side cream-colored flushed with dull reddish; the lines marked but obscure, except toward hind margin; apical half of hind margin tinged with brownish.

Head and antennæ brown; thorax and abdomen cream-color flecked with brown; middle segments of abdomen wholly brown, like the suffusion of hindwings; under side and legs cream-color varied with brown.

*Expanse of wings*.—25 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, December, 1904.

Allied to *H. commaculata* Warren, but much smaller.

*Type*.—Cat. No. 9244, U.S.N.M.

Genus *LIPOMELIA* Warren.*LIPOMELIA? TRISTRIGATA*, new species.

*Forewing*.—Dull yellow, covered with leaden-gray striæ, which are darker along costa, crossed by three brown stripes; first from a yellow spot near middle of costa; angled on subcostal, then oblique to about one-third of inner margin; second from a brown spot at three-fourths of costa, slightly sinuous, the lower part parallel to inner stripe; third from five-sixths of costa parallel to hind margin, but toward inner margin bent parallel to the other two; these stripes are finely edged with clear yellow, the striæ between partially coalescent with bands; dark marginal dashes; fringe deep yellow with tips purplish.

*Hindwing*.—Similar, the three stripes straight, parallel, and equidistant.

Under side deeper yellow with black dusting; the brown stripes narrow, inwardly broadly edged with bright orange; the veins orange; in the intervals between the veins beyond second and third stripes are patches of lustrous blue scales on the forewings.

Thorax and abdomen like wings; head and shoulders dark brown; abdomen beneath and legs orange-yellow speckled with brown.

*Expanse of wings*.—17 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, July, 1904.

The position of this species is doubtful in the absence of the male; the cell is short; 6 and 7 not stalked; hindwing triangular; hind margin straight; inner margin concave.

*Type*.—Cat. No. 9245, U.S.N.M.

Genus *LOBOCLETA*, new genus.

*Forewing*.—Triangular; costa curved only before apex; hind margin obliquely curved into inner margin without forming a real anal angle.

*Hindwing*.—As long as forewing; the inner margin short; hind margin rounded from apex to vein 4; thence nearly straight, excised beyond submedian interval, so that the anal angle becomes slightly lobed.

Antennæ of male strongly pectinated; of female simple; palpi large, porrect, roughly scaled below; hind tarsi aborted in the male; hind tibiæ in female with terminal spurs only.

*Neuration*.—Forewing, cell three-fifths of wing; discocellular oblique; first median nervule at two-thirds, second before third; radials normal; 7, 8, 9 stalked; 10 and 11 from cell; 10 anastomosing with 11 and again with 8, 9, forming a double areole; hindwing with 6, 7 stalked.

*Type*.—*Lobocleta translineata*, new species.

Distinguished by the neuration and the lobed anal angle of hindwing from *Cleta* Guenée and *Polygraphodes* Warren, which both have the antennæ of the male pectinated.

**LOBOCLETA TRANSLINEATA, new species.**

*Forewing*.—Cream-color, crossed by five buff lines, more or less parallel to the hind margin; the innermost straight, the median, outer, and submarginal incurved below middle, the fifth, marginal, consisting of spots between the veins; marginal line fine; buff; fringe cream-color; basal half of costal edge brown; no cell spot.

*Hindwing*.—Similar, but without inner line.

Under side darker; forewing tinged with grayish buff except along inner margin.

Palpi externally brownish; face and vertex white; collar brownish; thorax and abdomen cream-color; antennæ ferruginous.

*Expanse of wings*.—17 mm.

*Locality*.—Cayenne, French Guiana; 1 male, February, 1904; 1 female, January, 1904.

The female has the lines more diffuse, brownish gray, and is dusted all over with atoms of the same color; the marginal line is dotted with brown at the ends of the veins, those in the male being minute points only; the base of costa of forewing is hardly darker.

*Type*.—Cat. No. 9246, U.S.N.M.

**Genus LOBURA, new genus.**

*Forewing*.—Short and broad; the anal angle produced with a broad overlapping lobe; apex and hind margin rounded.

*Hindwing*.—Broad, almost round; inner half of inner margin amplified into a tuft-bearing lobe; the whole surface beneath hairy, especially along costal and inner margin.

Antennæ nearly simple; palpi porrect, short; abdomen tufted beneath; hind legs aborted, all but obsolete; fore and middle legs largely developed; mid tibiæ flattened, with dense hair on each side.

*Neuration*.—As in *Ptychopoda*: 6, 7 of hindwings long stalked; cell in both wings very broad.

*Type*.—*Lobura ocellata*, new species.

*Ptychopoda*? *amplimargo* Warren,<sup>a</sup> described from a worn specimen from Brazil, should be referred to this genus.

**LOBURA OCELLATA, new species.**

*Forewing*.—Fawn-color, with a reddish tint, covered with fine dark dusting; a dark linear cell spot followed by a small pale yellow blotch, before a dark gray outer line which is visible from costa to vein 3, where it becomes obsolete; a paler waved submarginal line which,

<sup>a</sup> Nov. Zool., IV, p. 443.

also, is untraceable below vein 3; the upper half of hind margin beyond it likewise paler; fine marginal dark dashes between the veins; fringe, like the margin, yellowish; the anal lobe is reddish tinged and the fringe round it.

*Hindwing*.—With dark cell spot and faint curved outer line; fringe yellowish.

Under side smoother and paler, more rufous.

Thorax and abdomen like wings; vertex whitish; face and palpi brown.

*Expanse of wings*.—16 mm.

*Locality*.—Cayenne, French Guiana, January, 1904; 1 male.

*Type*.—Cat. No. 9247, U.S.N.M.

#### Genus MNESITHETIS Swinhoe.

##### MNESITHETIS DECOLOR, new species.

*Forewing*.—Very pale whitish green with the markings a shade darker; these consist of an inner curved line at one-fourth, projecting outward above the median vein; an outer curved line from beyond middle of costa to middle of inner margin, incurved below middle and approaching inner line, the space between them rather deeper green, and containing a small green and white cell spot; before the hind margin are three waved darker green lines parallel to margin, the outside one very faint; fringe concolorous; a dark marginal line interrupted at veins.

*Hindwing*.—With only the outer lines.

Under side pale green; the costal half of forewing reddish tinged, also the marginal line.

Head, thorax, and abdomen, pale green; face, palpi, and forelegs, brown-red above, paler below.

*Expanse of wings*.—15 mm.

*Locality*.—Demerara, British Guiana; 1 male.

*Type*.—Cat. No. 9248, U.S.N.M.

##### MNESITHETIS RUFIPUNCTA, new species.

*Forewing*.—Dull green; the lines darker, first curved at about one-third; median outcurved round the large red-brown cell spot to middle of inner margin; outer line lunulate-dentate at four-fifths; marginal line fine, interrupted by pale dots at the vein ends; fringe, green; costal edge, ochreous-yellow.

*Hind margin*.—Without first line; cell spot silvery white.

Under side of forewing dull rosy, the outer line deeper; costa broadly dull yellowish; fringe, pale green beyond an interrupted red marginal line; hindwing, pinky ochreous, the costa and two outer lines rosy.

Face and palpi, deep red; vertex and antennæ, white; thorax and abdomen green, like wings; the anal half of dorsum tinged with reddish.

*Expanse of wings*.—25 mm.

*Locality*.—Tijuca, Brazil; 1 male.

*Type*.—Cat. No. 9249, U.S.N.M.

Genus OMOPERA, new genus.

*Forewing*.—Costa curved; apex blunt, but prominent; hind margin, strongly elbowed at end of vein 3, concave above and below, the lower half very oblique, running parallel to costa, and of the same length as inner margin, which is about half as long as costa.

*Hindwing*.—Small and narrow, semielliptical; the costa convex and curving into the hind margin without forming an apical angle.

Antennæ, male, pubescent; palpi, quite short; middle and hind legs with dense tufts of hair, the latter otherwise aborted; in the hindwing the cell area is puckered and hollowed out beneath; the costal margin beneath is clothed with wisps of hair; veins 2 and 3 are stalked as in *Ptychopoda subvestita* Warren and *chlorosata* Snellen.

*Type*.—*Omopera angulata*, new species.

OMOPERA ANGULATA, new species.

*Forewing*.—Olive-ochreous, with dull grayish purple scaling, which forms a large ill-defined cloud along lower half of hind margin from the elbow to anal angle, stretching toward middle of costa, where there are three indistinct spots, indicating origin of inner, median, and outer lines, but only the last is visible in its upper course; from another spot near apex a submarginal line runs to the elbow, and the extreme margin is purplish from the elbow to apex; a dark cell spot in the cloud; fringe olive-ochreous, broadly purplish at the elbow.

*Hindwing*.—With two thick ill-defined lines of purplish scales, forming a kind of fascia across middle of wing to inner margin above anal angle; a dark purplish shade along hind margin; fringe yellow.

Under side of forewing like upper, but paler; the cell spot, outer and submarginal lines clearer; hindwing with only the apical dark shadings.

Head, thorax, and dorsum purplish; patagia olive-ochreous; vertex white; tufts of hind legs purplish, of middle legs pale ochreous.

*Expanse of wings*.—20 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, April, 1904.

*Type*.—Cat. No. 9250, U.S.N.M.

## Genus PAMMERIS, new genus.

Closely related to *Tricentra* Warren, but instead of the single long, middle spur which the hind tibiae of the males of that genus possess, having two short middle spurs; the species can not, however, be referred to any of the existing genera in which the hind tibiae are fully developed and armed with four spurs.

*Type*.—*Pammeris albiguttata*, new species.

## PAMMERIS ALBIGUTTATA, new species.

*Forewing*.—With the inner margin for three-fourths pale violet, limited by a semicircular diffuse blackish purple edge running from base of costa to before anal angle; costal area diffusely purplish gray; the anal angle and hind margin narrowly yellow; a row of purple marginal spots between the veins; fringe yellow; on the inner margin in the pale violet area are visible the ends of three dark waved lines; two white minute dots at top and bottom of discocellular.

*Hindwing*.—Wholly violet, crossed by basal and waved postmedian and submarginal dark lines; a purplish black submarginal band, leaving the hind margin narrowly yellow, like the fringe; a row of marginal purple dots; discal mark a large, round, pure white spot.

Under side blackish beneath the violet areas of upper side; apical half of forewing dull pink, yellowish toward anal angle; fringes yellow; hindwing with the round white cell spot.

Head, throat, and abdomen violet.

*Expanse of wings*.—17 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana, November, 1904.

*Type*.—Cat. No. 9251, U.S.N.M.

## PAMMERIS FUMATA, new species.

*Forewing*.—With a smoky purplish patch on inner margin from base to anal angle, rounded above; the rest of the wing yellowish, but more or less obscured in the costal half of wing by a purplish suffusion, the anal angle also remaining yellow and unsuffused; in the outer area two dentate-lunulate dark lines are visible, nearly parallel to outer margin; marginal spots purple; fringe yellow.

*Hindwing*.—Wholly smoky purplish, the extreme hind margin only yellowish; fringe and marginal spots as in forewing; two white spots on discocellular, one at each end; the dark outer lines are just traceable.

Under side of forewing dull rosy, the inner margin narrow purplish gray; hindwing purplish gray, with the hind margin yellowish.

Head, thorax, and abdomen smoky purplish.

*Expanse of wings*.—16 mm.

*Locality*.—St. Jean, Maroni River, French Guiana, March, 1904.

*Type*.—Cat. No. 9252, U.S.N.M.

## Genus PTYCHOPODA Stephens.

## PTYCHOPODA FINITA, new species.

*Forewing*.—Yellowish ochreous, somewhat glossy; a small black cell spot; above it on the costa a slight dark spot and another on inner margin, between which a faint median line can be traced; outer line purplish black from quite two-thirds of costa straight toward anal angle as far as submedian fold, along which it runs shortly basewards, then vertical to inner margin; the marginal area purplish gray, except the apex, which remains ochreous; a row of dark marginal dashes between the veins; fringe ochreous.

*Hindwing*.—With the margin purplish gray from apex to anal angle, edged inwardly by the dark outer line; cell spot dark; fringe ochreous.

Under side like upper, but the costa of forewing rosy tinged.

Face and palpi purplish; vertex white; thorax and abdomen ochreous; the dorsum tinged with brownish.

*Expanse of wings*.—15 mm.

*Locality*.—Cayenne, French Guiana; 1 male, February, 1904.

Resembles *Ptychopoda limitata* Warren, from Venezuela, but the margin is much darker.

*Type*.—Cat. No. 9253, U.S.N.M.

## PTYCHOPODA FISSILINEA, new species.

*Forewing*.—Yellow, with deep rosy markings; costa purplish rosy to median line; first line from one-third of costa, obliquely curved inward; median wavy, intent to touch the small cell spot and again below middle; outer line from three-fourths, thick and denticulate, strongly incurved on submedian fold; followed closely by a purplish dentate shade, the interval in one case filled up with purplish so as to form a band; a narrow purplish shade before margin, obsolete below middle; fringe yellow, broad; no marginal spots.

*Hindwing*.—With the base purplish and a thick antemedian purplish line straight from one-third of costa to middle of inner margin; the rest as in forewing.

Under side with the markings clearer.

Face and palpi deep rosy; vertex and antennæ white; thorax and abdomen yellow, more or less tinged with red; in one female wholly red.

*Expanse of wings*.—Male, 11 mm.; female, 13 mm.

*Locality*.—Cayenne, French Guiana; 1 male, 2 females, January, February, and June, 1904.

The hind margin of hindwings is strongly rounded.

*Type*.—Cat. No. 9254, U.S.N.M.

**PTYCHOPODA FLAVICINCTA**, new species.

*Forewing*.—Violet; the costa paler; fringe, and a rather broad stripe of hind margin, yellow; the violet darker before the yellow.

*Hindwing*.—The same.

Under side violet; the space beyond the deep violet shade and the fringe dull rosy; in the hindwing the violet area is traversed by a dark shade at middle as well as before the yellow fringe.

Head, thorax, and abdomen violet; base of shoulders whitish.

*Expanse of wings*.—9 mm.

*Locality*.—Cayenne, French Guiana, January, 1904.

*Type*.—Cat. No. 9255, U.S.N.M.

**PTYCHOPODA FLEXIVITTA**, new species.

*Forewing*.—Pale yellow, crossed by four slightly lustrous lilac bands edged with reddish; the costal margin of the same color and the base of wing narrowly; antemedian and median bands elbowed outward at middle, incurved above and below; outer band more sinuous, elbowed outward on veins 6 and 3, insinuate on the folds; marginal band narrower, and not reaching anal angle; fringe yellow.

*Hindwing*.—With four bands, one at base, one antemedian, straight; the postmedian sinuous and the outer marginal also complete and sinuous.

Under side pale straw-color, with the bands blurred and obscure.

Head, collar and antennæ red-brown; thorax and abdomen yellow; forelegs red-brown in front.

*Expanse of wings*.—12 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, March, 1904.

Hindwing with veins 3, 4 stalked as well as 6, 7.

*Type*.—Cat. No. 9256, U.S.N.M.

**PTYCHOPODA IMBELLIS**, new species.

*Forewing*.—Bone-color, sprinkled with gray scales; the lines slightly marked, darker gray, oblique, parallel to hind margin; inner at one-third; median, thicker, at nearly two-thirds; outer at three-fourths, indented at submedian fold; submarginal faint; cell spot blackish, small, touching the median shade; marginal line faintly blackish; fringe speckled, like wings.

*Hindwing*.—With the cell spot blackish, distinct, and the three outer lines.

Under side dark gray in forewing, lighter in hindwing, with outer line in each wing and the cell spot distinct.

Thorax and abdomen dark gray; head wanting.

*Expanse of wings*.—15 mm.

*Locality*.—Jamaica; 1 female.

*Type*.—Cat. No. 9257, U.S.N.M.

## PTYCHOPODA MARASCIA, new species.

*Forewing*.—Pale ochreous with a slight olive tinge; first line very obscure at one-third, obliquely curved; outer line from three-fourths of costa to two-thirds of inner margin, starting from a dark brown spot, obliquely curved parallel to hind margin and forming a slight sinus outward below vein 4; basal space and marginal area darkened with pale brownish gray scales which extend along costa to the middle of wing; in the marginal area a pale waved submarginal line; fringe concolorous; cell spot black.

*Hindwing*.—Similar, but without basal markings.

Under side like upper, but the brown markings deeper; a marginal row of dark dashes.

Head, thorax, and abdomen olive-ochreous; face, palpi, and shoulders brownish; vertex white; dorsum shaded with brown.

*Expanse of wings*.—17 mm.

*Locality*.—Castro, Parana, Brazil; 1 male, 1 female.

*Type*.—Cat. No. 9258, U.S.N.M.

## PTYCHOPODA MUSCIFASCIATA, new species.

*Forewing*.—Bone-color, suffused with dull flesh-color, more deeply toward hind margin; first and second lines from one-third and two-thirds of costa, dark moss-green; the first simply curved, the second outcurved round cell and waved, running in along vein 3 to inner margin just beyond middle; this outer line is broadly edged inwardly with dark moss-green, which at inner margin extends to inner line, and outwardly is followed by a pale line; submarginal line pale, wavy; fringe pale; cell spot moss-green; the green band before outer line is interrupted between 2 and 3.

*Hindwing*.—With the band antemedian, indented in middle; base of wing pale, with moss-green atoms; outer half uniform flesh-color with straight pale submarginal line.

Under side olive-gray and ochreous; cell spots and vein dots marking outer line, blackish, the dark green band showing through.

Face and palpi dark red-brown; vertex whitish; shoulders and patagia bone-color; abdomen flesh-color, with a dark green spot on second segment.

*Expanse of wings*.—16 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, July, 1904.

*Type*.—Cat. No. 9259, U.S.N.M.

## PTYCHOPODA PURPUREOVITTATA, new species.

*Forewing*.—Pale yellow, sprinkled with purplish scales, except just before outer line, and most thickly near base; at one-fourth and one-half of costa two purplish spots from which indistinct inner and median

lines rise, both indented on submedian fold, the median widely out-curved round the purplish cell spot; outer line deeper purple, from three-fourths of costa to just before anal angle, faintly excurved below middle, followed by a purplish band with irregular outer edge; a row of purplish marginal spots; fringe yellow.

*Hindwing*.—Similar, without inner line; the outer line more distinct.

Under side paler, the markings clearer; a slight submarginal shade is more distinct than on upper side.

Face deep red; vertex and antennæ white; thorax and abdomen yellow ochreous with reddish dusting.

*Expanse of wings*.—11–12 mm.

*Locality*.—Cayenne, French Guiana; 2 females, January, February, 1904.

The second of these specimens is entirely suffused with purplish on the upper side, and on the thorax and dorsum; the fringes dull yellow.

Veins 3, 4 as well as 6, 7 stalked in the hindwings.

*Type*.—Cat. No. 9260, U.S.N.M.

#### PTYCHOPODA RUFARENARIA, new species.

*Forewing*.—In male ochreous, slightly dusted with grayish rufous; in female sandy-ochreous, more thickly dusted throughout; lines darker, more conspicuous in the male; the inner at one-third, slightly curved at costa, then straight and vertical; the outer from three-fourths of costa, outcurved, and below middle slightly crenulate, inbent on submedian fold; a faint median shade touching the black cell spot; marginal area more thickly dusted; marginal line purplish; fringe rufous, with dark checkering beyond veins in basal half.

*Hindwing*.—Without basal line.

Under side yellowish, with cell spots; outer, and marginal lines dull purplish; forewing with the cell and costal area above it, and the marginal area rufous; in the female both wings are more uniformly tinged both above and below.

Head, thorax, and abdomen like wings; face dark brown-red.

*Expanse of wings*.—16 mm.

*Locality*.—Cayenne, French Guiana; 1 female, 1 male, January, February, 1904.

*Type*.—Cat. No. 9261, U.S.N.M.

#### PTYCHOPODA SIMILINEA, new species.

*Forewing*.—Deep yellow, with an olive flush, crossed by four waved purplish rosy lines, placed almost exactly as the bands in *P. flexivitta*, the costa also being dark purplish rosy throughout; fringe yellow.

*Hindwing*.—With four similar lines.

Under side much paler, straw-yellow; the forewing largely suffused with dull rosy; the lines in both wings dull rosy; in forewing the cell

spot and outer line toward costa become blackish. Head and antennæ deep purplish brown; thorax and abdomen yellow.

*Expanse of wings.*—11 mm.

*Locality.*—St. Jean, Maroni River, French Guiana; 1 female, March, 1904.

Hindwing with veins 3, 4 stalked, as well as 6, 7.

*Type.*—Cat. No. 9262, U.S.N.M.

**PTYCHOPODA TENEBRICA, new species.**

*Forewing.*—Gray, dusted with darker; the lines dark, starting from black costal spots at one-third, one-half, and two-thirds; the first and second angled in cell; the third on vein 6, then all oblique inward and waved, the outer marked by black spots on veins; space between first and submarginal line, which is pale and waved, blacker gray than the rest of wing; cell spot black; a fine marginal line; fringe gray, with dark checkering.

*Hindwing.*—Without basal line.

Under side cinereous, with all the markings darker.

Head, thorax, and abdomen like wings; face and palpi black.

*Expanse of wings.*—15 mm.

*Locality.*—Santiago, Cuba; 1 male, June, 1902.

*Type.*—Cat. No. 9263, U.S.N.M.

**PTYCHOPODA USTIMARGO, new species.**

*Forewing.*—Bone-color with a faint olive-gray tinge; costa narrowly purple; cell spot small and dark; a thick minutely crenulate dark purple outer line from three-fourths of costa straight toward hind margin at end of vein 2, there bluntly bent inward to submarginal fold and again at right angles to anal angle, the area beyond filled in with purplish gray, becoming paler and more ochreous toward costa; marginal line thickly deep purplish; fringe brownish rufous. In the single specimen there are traces of a fine curved median line and of an inner line on inner margin; these are probably more distinct in some specimens.

*Hindwing.*—With more visible traces of two dark lines across wing; marginal line and fringe as in forewing, the former preceded from apex to middle by a narrow purplish shade.

Under side ochreous, suffused with rosy; the marginal areas and fringes rosy brown.

Head dark purple; thorax and abdomen like wings, but the dorsum purplish.

*Expanse of wings.*—17 mm.

*Locality.*—Geldersland, Surinam River, Dutch Guiana; 1 female.

Veins 3, 4 of hindwings stalked, as well as 6, 7.

*Type.*—Cat. No. 9264, U.S.N.M.

## PTYCHOPODA VAGULA, new species.

*Forewing*.—Pale olive-ochreous; crossed by three broadish white lines, the first curved before middle, the second beyond middle, also curved and indented below median; the third submarginal, from before apex to anal angle, waved above; space between first and second lines darkened with gray scales, especially outwardly; a row of minute blackish marginal dots; fringe concolorous.

*Hindwing*.—Without first line; some dark scales before median line.

Under side suffused with ochreous, the markings showing through. Thorax and abdomen like wings; vertex and antennæ white; face and palpi black.

*Expanse of wings*.—12 mm.

*Localities*.—St. Jean, Maroni River; 1 male, April, 1904; Cayenne, French Guiana; 2 males, January and February, 1904.

*Type*.—Cat. No. 9265, U.S.N.M.

## PTYCHOPODA VITTICOSTATA, new species.

Superficially much like *P. griseocostata* Warren, from which it may be distinguished by the following points; the red coloring is paler; the ochreous gray costal streak is much broader and reaches to apex instead of stopping short at two-thirds of costa; there are clear traces of red cross lines especially of a much outcurved postmedian and a broad submarginal. The hindwing appears to be angled at vein 6, owing to the red marginal band running out into the yellow fringe, which is not the case in *griseocostata*. Lastly the present species expands 14 mm. only, as against 17 mm. in the other.

*Locality*.—St. Jean, Maroni River, French Guiana, March, 1904.

*Type*.—Cat. No. 9266, U.S.N.M.

## Genus SCHISTOCOLPIA, new genus.

An offshoot from *Dysephyra* Warren, characterized by an abnormal structure of the hindwing of the male. The hind margin of the wing is deeply excised along vein 5 for half the length, the sides of the incision fringed; this is concealed on the under side by a broad fringe of long silky hairs, rising from the base of the joint stem of veins 6 and 7 and curving along vein 6 to the end of the incision on hind margin, the hairs decreasing in length suddenly; the course of vein 6 is curved, not straight; the hind margin is, besides, incurved from vein 7 to 4, where it is bluntly prominent, so that the general outline of the wing appears irregular.

The antennæ of the male, as in *Dysephyra*, are fasciculate-ciliate.

*Type*.—*Schistocolpia crinita*, new species.

## SCHISTOCOLPIA CRINITA, new species.

*Forewing*.—Dull red-brown, the costal edge pale ochreous; markings brownish, very obscure; a curved inner line from one-half of costa to one-third of inner margin; a median line from beyond middle of costa, excurved round cell to beyond middle of inner margin; both these thick and diffuse; outer line finer and marked by dark spots on veins; from three-fourths of costa to inner margin close before anal angle, strongly insinuate below vein 3 parallel to median; a fine dark marginal line, interrupted at each vein; fringe concolorous with small dark dots beyond veins; cell spot black, small.

*Hindwing*.—Like forewing, but the cell spot snow-white with black edging which is slightly produced toward costa.

Under side dark rosy with the outer line deeper; forewing with a subcostal streak of ochreous scales; in the female the cell spot of hindwing shows whitish.

Head, thorax, and abdomen concolorous with wings; anal segment of abdomen ochreous; face and palpi deep red; vertex and antennal shaft snow-white; legs and abdomen beneath dull rosy.

*Expanse of wings*.—30 mm.

*Localities*.—St. Laurent, Maroni River; 1 male, December, 1904; Cayenne, French Guiana; 1 male, January, 1904.

*Type*.—Cat. No. 9267, U.S.N.M.

## Genus STERRHA Hübner.

## STERRHA FARADA, new species.

*Forewing*.—Thickly clothed with dull rufous and olive scales; the lines darker, diffuse, and indistinct; first line bent in cell, then oblique; a thick median shade, curved beyond the cell spot, which is indistinctly ocelloid with center pale; outer line finer; dentate-lunulate at five-sixths; a dark marginal line; fringe gray.

*Hindwing*.—Without first line.

Under side pale ochreous, in the forewing suffused with pinkish gray; the outer lines marked in both wings.

Head, thorax, and abdomen like wings; face and palpi brown above, paler below.

*Expanse of wings*.—25 mm.

*Locality*.—Guadalajara, Mexico; 1 female.

Near to *Sterrha inficeta* Dognin, from Ecuador, and also resembling *Emmiltis ochratipennis* Warren, from Venezuela, but this is yellower. Hind tibiae with terminal spurs only.

*Type*.—Cat. No. 9268, U.S.N.M.

Genus *SYNELYS* Hulst.*SYNELYS IRRUFATA*, new species.

*Forewing*.—Ochreous with a pinkish flush and dusted with gray; all the lines darker pinkish; first line fine and obscure, sharply angled in cell, from one-fifth of costa to one-fourth of inner margin; median shade thick, with obscurely dentate edge, from costa just beyond middle; angled on vein 6, then oblique to middle of inner margin, the minute dark cell dot on its inner edge; outer line from five-sixths of costa to three-fourths of inner margin, lunulate-dentate, angled acutely outward on vein 6, followed by two submarginal lines; marginal dots small; fringe concolorous.

*Hindwing*.—Similar, but without inner line.

Under side of forewing pinkish gray; of hindwing clear pale ochreous; the outer lines, cell spots, and marginal dots represented.

Face, palpi, and collar dark, black-brown; vertex, antennæ, thorax, and abdomen like wings.

*Expanse of wings*.—24 mm.

*Locality*.—Jalapa, Mexico; 1 male.

*Type*.—Cat. No. 9269, U.S.N.M.

Genus *TRICENTRA* Warren.*TRICENTRA AURILIMBATA*, new species.

*Forewing*.—Uniformly lake-red; the fringe and a narrow strip of margin bright yellow; the edge of the red ground uniformly undulating between the veins; the three lines similarly wavy, slightly darker than ground color; the inner simply curved, the two outer excurved above and incurved below middle; discal mark a long narrow line of whitish, each end a white dot.

*Hindwing*.—The same, without first line.

Under side very pale pink, the fringes pale yellow; costa of forewing deep red at base.

Head, thorax, and abdomen above red like wings; abdomen below; pectus, and legs, lower part of face, and under side of palpi pale ochreous; antennæ and fore legs deep red.

*Expanse of wings*.—17 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; January, 1905.

*Type*.—Cat. No. 9270, U.S.N.M.

*TRICENTRA BIGUTTATA*, new species.

*Forewing*.—Dull pink, suffused with olive-gray-brown; this suffusion extending over the basal area to first line, along the costa, between the discocellular and the second line, and forming streaks between the

veins toward hind margin; the three lines rather thick, olive-fusca, waved; the two outer, as usual, outcurved above middle and incurved on submedian fold, the inner line outcurved on the same fold and nearly touching second; on discocellular two large round silvery-white spots finely ringed with scarlet; marginal line olive-fusca, thick; fringe pale yellow, with gray dusting.

*Hindwing*.—Like forewing.

Under side dull grayish pink; the fringe dull yellow.

Head, thorax, antennæ, and forelegs olive-fusca; the face red-brown; under side of abdomen and legs dull pink.

*Expanse of wings*.—18 mm.

*Locality*.—St. Jean, Maroni River, French Guiana, March, 1904.

*Type*.—Cat. No. 9271, U.S.N.M.

**TRICENTRA BRUNNEOMARGINATA, new species.**

*Forewing*.—Whitish straw-color; the costal and hind margins broadly olive-brown; the costal margin at base starting from inner margin; the apex more broadly brown; cell mark double, formed by two white spots, that at upper end of discocellular a dot, the lower one round and large, both surrounded by brown scales on a yellow ground; three wavy red lines, antemedian, median, and postmedian, the last two outcurved widely above and incurved on submedian fold; the edge of the brown costal margin at base is edged with red, and the curved inner edge of the outer margin with red wedge-shaped marks on veins preceding a dark brown dentate line; marginal line dark brown, fringe dark olive yellowish, with brown patches at apex; middle, and anal angle, the yellow tinge slightly encroaching on the brown margin above and below middle.

*Hindwing*.—Similar, but the two cell marks both large and white.

Under side pinky cream-color; the dark markings brownish rosy; cell of forewing also rosy tinged; fringe olive-yellow.

Head, shoulders, patagia, and base of abdomen red-brown, rest of abdomen ochreous tinged with brown; lower half of face, fillet, thorax, and base of patagia ochreous; abdomen below and legs ochreous; forelegs red-brown.

*Expanse of wings*.—17 mm.

*Locality*.—St. Jean, Maroni River, French Guiana, October, 1904.

*Type*.—Cat. No. 9272, U.S.N.M.

**TRICENTRA COLLIGATA, new species.**

*Forewing*.—Yellow; the costa narrowly bronzy purple; all the markings blood-red; these consist of an antemedian and postmedian line, and a median and marginal fascia; these are all connected by a horizontal band running from base to hind margin along the submedian fold; fringe yellow, marked at apex and from vein 4 to 1 with blood-red.

*Hindwing*.—With three large blood-red costal blotches giving rise to two thick curved lines attenuated in middle, and a broad marginal band; base of wing marked also slightly with red; fringe yellow with a blood-red patch at middle.

Under side dull red; forewing with anal region yellow and upper half of fringe; hindwing with base and two narrow bands yellow; fringe yellow except at middle. Collar, vertex, antennæ, face, and palpi deep red; shoulders, thorax, and basal half of patagia yellow; tips of patagia red; dorsum red with a yellow stripe down the middle; under side of abdomen and legs yellow; legs externally rosy.

*Expanse of wings*.—11 mm.

*Locality*.—Cayenne, French Guiana; June, 1904.

*Type*.—Cat. No. 9273, U.S.N.M.

**TRICENTRA CONSEQUENS, new species.**

*Forewing*.—Bright brick-red, along the costa and toward apex lilac-gray; the costa with brown dusting; lines red-brown; first near base strongly outcurved in cell before the cell spot, which consists of two partially confluent silvery white dots followed immediately by a quadrate deep red-brown patch; outer and submarginal lines parallel to each other, outcurved to submedian fold; hind margin yellow, more broadly above middle, preceded by a purplish brown band, which is itself broader above middle; fringe yellow.

*Hindwing*.—Wholly brick-red, with similar markings; the brown band before the yellow hind margin of uniform width.

Under side pale pink, darker toward margin, with the outer line darker; fringes and hind margins pale yellow.

Head dark brown; thorax and abdomen bright brick-red.

*Expanse of wings*.—17 mm.

*Locality*.—Cayenne, French Guiana; 2 males, January, 1904.

*Type*.—Cat. No. 9274, U.S.N.M.

**TRICENTRA FLAVISTIGMA, new species.**

*Forewing*.—Uniform dark violet; the fringe and extreme hind margin yellow; the extremity of the violet area crenulate from vein to vein and touching margin at vein 3; three dark waved cross lines, the inner simply curved, the outer two incurved below middle; cell spot a long oval, yellow, edged with red; costal edge narrowly white.

*Hindwing*.—Like forewing.

Under side duller; the yellow cell marks plainer.

Head, thorax, and abdomen concolorous with wings; vertex and antennal shaft snow-white.

*Expanse of wings*.—18 mm.

*Locality*.—Rockstone, Essequibo, British Guiana, September, 1904.

*Type*.—Cat. No. 9275, U.S.N.M.

**TRICENTRA IGNEFUMOSA, new species.**

*Forewing*.—With a broad costal streak and outer third of wing olive; the rest of wing to three-fourths of inner margin and as far as the cell-fold deep red, edged outwardly by a thick dark shade; base of costa deep purple; the three lines purple, first oblique outward from one-sixth of costa, outcurved above and below median, to one-third of inner margin, the inclosed space deeper red; postmedian and submarginal lines dentate-lunulate, parallel, outcurved above and incurved to vein 2, thence vertical; a small white dot at lower end of discocellular; fringe yellow, slightly tinging the outer margin.

*Hindwing*.—With the whole basal half red, its outside edge darkened by two thick nearly coalescent black lines; the extreme base deeper red; cell mark angulated, yellow, wider at extremities than in middle; rest of wing olive; fringe yellow.

Under side smooth pinkish white, the forewing suffused with dull purple; a postmedian thick median shade across each wing, blackish, tinged with vinous; fringes yellow.

Head, thorax, and basal half of abdomen red; anal half olive; under side and legs pinkish ochreous; forelegs red.

*Expanse of wings*.—17 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana, November, 1904.

*Type*.—Cat. No. 9276, U.S.N.M.

**TRICENTRA PERCROCEA, new species.**

*Forewing*.—Golden yellow, speckled with reddish brown scales; the base and apex above middle suffused with red-brown; basal lines very obscure, outcurved at one-third; the two outer lines from three-fifths and three-fourths of costa to two-thirds and five-sixths of inner margin, respectively, both strongly dentate, but the inner of the two obscurely marked, except beyond cell, where it bears two large teeth more or less confluent into a blotch; an interrupted dark marginal line; fringe yellow, with a black blotch at vein 4.

*Hindwing*.—Yellow; only the submarginal line marked, the area beyond it dusted with olive scales; on the discocellular two single rings of purplish scales; fringe pale yellow, dusted with gray toward apex.

Under side pale yellow; upper half of forewing dull rosy; the dark blotch in postmedian line square and prominently darker, running out into the dark spot in fringe.

Head, thorax, and abdomen deep yellow, varied with red; collar vertex, upper part of face, and palpi reddish; third segment of abdomen marked with red-brown.

*Expanse of wings*.—16 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; March, 1904.

Forewing bluntly bent at vein 4; when fresh the forewing possibly has a discal mark like the hindwing.

*Type*.—Cat. No. 9277, U.S.N.M.

**TRICENTRA VINOSATA, new species.**

*Forewing*.—Deep vinous-red, suffused with darker, more or less obliterating all markings; fringe yellow from apex to middle where the wing is indented, and again beyond submedian interspace, where the extreme hind margin also is yellow; a minute dot of silvery white scales at bottom of discocellular.

*Hindwing*.—Slightly paler, showing a dark basal line, broad median fascia, and acutely dentate postmedian line; marginal line dark before the yellow fringe, which is broadly interrupted with vinous beyond vein 6 and below middle; cell spot linear, paler vinous.

Under side deep dull rosy, with the fringe yellow.

Head, thorax, and abdomen deep vinous; abdomen beneath and legs pinkish ochereous.

*Expanse of wings*.—18 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana, November, 1904.

*Type*.—Cat. No. 9278, U.S.N.M.

**Subfamily HYDRIOMENINÆ.**

**Genus EUDULE Hübner.**

**EUDULE BASIPUNCTA, new species.**

*Forewing*.—Greenish brown, the same color as in *E. annuligera* Warren, slightly transparent, with the veins and cell spot showing darker; a small red spot at extreme base.

*Hindwing*.—Deep red; the base, costa, from before middle and hind margin blackish, of uniform width; fringe blackish; inner margin quite narrowly black; a small black cell spot.

Under side like upper, but the forewing paler.

Head, thorax, and abdomen blackish; a red spot at sides of thorax.

*Expanse of wings*.—22 mm.

*Locality*.—Chachapoyas, Peru, 1889 (de Mathan); 1 male.

*Type*.—Cat. No. 9279, U.S.N.M.

**EUDULE PARCA, new species.**

*Forewing*.—Semitransparent, dull red at base, dull smoky blackish in the larger outer half, costa narrowly dark from base; the red color occupies three-fourths of the length of the cell ending in a round projection and fills up the space between veins 1 and 2, ending at four-fifths in a blunt projection; inner margin dark below vein 1; fringe smoky blackish.

*Hindwing*.—Smoky blackish, the costa from base to halfway and reaching to middle of cell red.

Underside like upper.

Head, thorax, and abdomen blackish.

*Expanse of wings*.—26 mm.

*Locality*.—Loja, Ecuador; 1 male.

The amount of red is much more restricted, especially in the hindwings, than in *E. herona* Druce.

*Type*.—Cat. No. 9280, U.S.N.M.

#### Genus LEPTIDULE Butler.

##### LEPTIDULE SULCIFERA, new species.

*Forewing*.—Deep yellow, more opaque along the margin, semitransparent in the center below median vein, which runs not along the center of wing, as usual, but at only one-fourth from costa, the cell with a longitudinal furrow from base to end and a thickening and contortion of the wing membrane toward end below the subcostal.

*Hindwing*.—Without furrow or contortion.

Underside the same.

Head, thorax, and abdomen concolorous with wings; antennæ, front of forelegs, and the tarsi of all the legs blackish.

*Expanse of wings*.—30 mm.

*Locality*.—Oaxaca, Mexico; 1 male.

*Type*.—Cat. No. 9281, U.S.N.M.

#### Genus CAMBOGIA Guenée.

##### CAMBOGIA CANCELLATA, new species.

*Forewing*.—Pale yellow; the veins and lines reddish brown; the lines all thicker at costa; four in basal area, all bent in cell, then inwardly oblique; the fourth obsolete below middle; fifth, parallel to the other four, touches the large black cell spot forming the inner edge of the central fascia; three postmedian lines, angled outward on veins 6 and 4, complete the band; above the cell spot an oblique streak from costa runs into the sixth line; three finer waved, lunulate and submarginal lines, the third hardly visible; marginal line crenulate; fringe yellow, checkered with brown.

*Hindwing*.—With two short lines close to base, followed by the brown-black cell spot, the lines beyond it as in forewing, but somewhat less regular.

Underside whitish; the lines showing dull brown; the cell spot black.

Face and palpi deep ferruginous; vertex and thorax yellow, spotted with brown; abdomen wanting.

*Expanse of wings*.—30 mm.

*Locality*.—Carabaya, southeastern Peru; 1 male.

The hind margin of both wings is distinctly crenulate, of hindwing faintly angled at vein 4.

*Type*.—Cat. No. 9282, U.S.N.M.

Genus **BOMBIA**, new genus.

Distinguished from *Heterusia*, with which it agrees in neuration, by the shape of wings.

*Forewing*.—Costa sinuate, indented before apex, which is bluntly produced and subfalcate; hind margin strongly protuberant in middle.

*Hindwing*.—Protuberant at middle of hind margin and with the anal angle lobed; the inner margin strongly lobed at one-third.

Antennæ lamellate, quite simple; face and palpi hairy; tongue and frenulum present, the latter very fine.

*Type*.—*Bombia protuberans*, new species.

**BOMBIA PROTUBERANS**, new species.

*Forewing*.—Dark fuscous-brown, toward base more olive-brown; an oblique oval white blotch beyond cell between veins 5 and 3, its lower edge along vein 3 flattened; fringe concolorous.

*Hindwing*.—With the base more broadly olive-brown and without a blotch.

Under side of forewing in basal half deep snuff-brown, the outer area grizzled-gray, the apex paler; the white blotch as above; hindwing, grizzled-gray, striated with black, with the inner margin and two outer bands obscurely reddish.

Head, thorax, and abdomen olive-brown, legs ochreous with darker color.

*Expanse of wings*.—24 mm.

*Locality*.—Chachapoyas, Peru, 1889 (de Mathan), 1 male.

The unique specimen is, unfortunately, much wasted.

*Type*.—Cat. No. 9283, U.S.N.M.

Genus **ERATEINA** Doubleday.

**ERATEINA BRUNNEA**, new species.

*Forewing*.—Dark olive-brown, more olive toward base, tinged along hind margin and toward anal angle with red; a slightly curved hyaline white band just beyond middle from below subcostal vein to vein 2 at two-thirds of its length; the veins across it marked darker on its outer edge; fringe brown and red, the tips white.

*Hindwing*.—Dull coppery red, the basal two-fifths dull olive-fuscous; a narrow blackish margin to vein 6, below it marked only by a few blackish scales on the veins, which are dark at their ends; fringe white between the veins, blackish beyond them.

Under side of forewing purplish red, paler red mixed with yellow

scales toward hind margin; inner margin below median vein nearly to anal angle silvery white, its outer edge commencing as a broad spot in middle of cell; discocellular marked by a narrow lustrous line; the white hyaline band extended to costa above and there opaque, below vein 2 curved and quite narrow, inclosing a dull blackish space; a dull yellow submarginal streak; fringe olive, mottled with paler; hindwing with the flap and space immediately beyond vinous-red splashed with silvery scales and with the veins pale before a wavy-edged band of which the upper half is silvery white and the lower pale fawn-color, followed by a broader band of orange-red, edged above with some yellow scales; marginal area deep vinous-red, varied with black and yellow scales, running out into the fringe along the veins, which between them is bright white.

Head, thorax, and abdomen olive-fuscous; orbits of the eyes, a fine line down center of face, and under side of palpi white; segmental rings of abdomen yellow above, white beneath; pectus and femora silky white, rest of legs mottled with pale.

*Expanse of wings*.—40 mm.

*Locality*.—Bolivia; 1 male.

The hindwing is shaped much as in *undulata* Saunders, and the white band of forewing is nearest that of *drucei* Theirry-Meig.

*Type*.—Cat. No. 9284, U.S.N.M.

#### ERATEINA SATELLITES, new species.

*Forewing*.—Dark olive-brown; the veins and costal edge whitish, especially toward hind margin; a roundish hyaline white blotch between veins 2 and 4 at their origin touching the fine white cell mark; beyond it toward hind margin between veins 2 and 3 a small round yellow spot; fringe (worn) concolorous.

*Hindwing*.—Brown-black with a hyaline white central blotch with curved outer edge running from vein 6 to 2, its basal edge diffuse.

Under side of forewing like upper, but the veins toward margin broadly pale and the discocellular white and crescentic; hindwing white, with broad dark marginal border crossed by white veins, and with a white marginal line and a yellow blotch between veins 2 and 3; flap white and small.

Head, thorax, and abdomen fuscous; segments of abdomen ringed with white; edges of patagia ochreous; corslet yellow; face black, with white cheeks.

*Expanse of wings*.—30 mm.

*Locality*.—Bolivia; 1 male.

Hindwings rounded, as in *siliquata* Guenée and *radiaria* Herrich-Schaeffer.

*Type*.—Cat. No. 9285, U.S.N.M.

## Genus OREONOMA Warren.

## OREONOMA RUBRIPLAGA, new species.

*Forewing*.—Brown-black, with four orange-red blotches; three above middle of wing, and one much larger below it; the three outwardly oblique and parallel, first quite small at middle of cell, the second oval along the discocellular, the third twice as long but narrower, reaching from vein 8 to 4; the large one below lies along vein 1, is broadest at middle and almost or quite touches the discocellular spot above; a minute red dot on vein 2; costa at base obscurely reddish; fringe brown-black.

*Hindwing*.—Brown-black with obscure red submarginal dots on veins 1 and 5 and on the submedian fold; fringe concolorous.

Under side of forewing blackish brown; costa and apex red; base of costa with two yellow spots; the orange spots as above, the outermost extended to costa and there whitish; the cell with scattered orange scales; fringe and hind margin brown; hindwing olive-brown; the base of costa and a broad smear from base of cell narrowing to hind margin silvery white, both edged with and concealing some vinous-red scales; fringe brown above vein 4, with the basal half silvery white, preceded by vinous scales.

Head, thorax, and abdomen black-brown, the thorax with some reddish hairs; abdomen beneath and the rough hairs on the femora of legs whitish.

*Expanse of wings*.—33 mm.

*Locality*.—Cajon, Peru; 1 male.

*Type*.—Cat. No. 9286, U.S.N.M.

## Genus TROCHIODES Guenée.

## TROCHIODES SUBPOHLIATA, new species.

*Forewing*.—Deep black, with an oblique hyaline white blotch from subcostal vein before middle, bounded below by vein 2, its outer end widened and rounded, reaching to two-thirds of vein 3, twice slightly indented outwardly and once inwardly, the veins across it finely black; the subcostal vein before it along cell fringed with a comb of long oblique dark hairs, from the base of which a long pencil of ochreous hair rises, reaching to end of cell, but normally concealed in a furrow running below median vein between it and a raised blister-like patch below cell; inner margin with a streak of blue scales from base to beyond middle.

*Hindwing*.—Hyaline white, with the borders broadly black; the white space resembling that in *T. cachara* Schaus, the veins across it white, except shortly along margins; fringe black, with a white spot between veins 5 and 6; inner margin blue, as in forewing.

Under side as in *pohliata* Felder; forewing with a deep indented furrow from above submedian fold from near base to below end of cell.

*Expanse of wings*.—35 mm.

*Locality*.—San Antonio, Bolivia (Garlepp), 1 male.

The type of *pohliata* Felder is a female.

*Type*.—Cat. No. 9287, U.S.N.M.

#### Genus COPHOPODA, new genus.

*Forewing*.—Elongate; costa straight; apex acute, especially in female; hind margin obliquely curved, in female slightly sinuous.

*Hindwing*.—Elongate; inner margin proper very short, visibly lobed, almost in a line with lower part of hind margin, which is bluntly bent at vein 4.

Antennæ of male bipectinate for two-thirds, the pectinations thickened upward; of female filiform; palpi slender, porrect, short, not reaching beyond face; tongue fine; frenulum present; fore and middle legs long and slender; hind legs short, somewhat aborted, without spurs; abdomen long in both sexes; anal tuft bifid above.

*Neuration*.—Forewing, cell more than half as long as wing; discocellular short, vertical; first median nervule at three-fourths; second at seven-eighths; radials normal, but 5 somewhat above middle of discocellular; 7, 8, 9, stalked; 10 and 11 from cell, 10 anastomosing with 11 and again with 8, 9, the areole being double; hindwing, costal and subcostal anastomosing nearly to end of cell; 6, 7 hardly stalked; discocellular oblique, radial from the center; medians as in forewing.

*Type*.—*Cophopoda pyralidimima*, new species.

#### COPHOPODA PYRALIDIMIMA, new species.

*Forewing*.—Rusty ochreous, dusted with dark gray; the base of costa and streaks along the two folds somewhat paler, with the dusting thicker; the two lines dark gray, but obscure; first from one-fourth of costa to one-third of inner margin, sharply angled in cell; outer from two-thirds of costa to two-thirds of inner margin, angled on vein 6; just beyond it on inner margin traces of a parallel median shade; cell spot brown; a row of marginal black dots between veins; fringe rusty gray, darker, the basal half darker; costa dotted with blackish.

*Hindwing*.—Grayish ochreous, thickly dusted with dark gray, with a pale curved submarginal space; cell spot dark; fringe of inner margin long, dusky with black.

Under side gray-brown thickly powdered with dark atoms; outer line and cell spots brown.

Vertex and thorax like forewing; abdomen like hindwing; face and fore legs brownish; antennal shaft pale ochreous, the pectinations blackish.

*Expanse of wings*.—Male, 22 mm.; female, 20 mm.

*Locality*.—Castro, Parana, Brazil; 2 males, 1 female.

The single female is paler and slightly smaller than the males.

*Type*.—Cat. No. 9288, U.S.N.M.

Genus *DOCHEPHORA* Warren.

*DOCHEPHORA FUMOSA*, new species.

*Forewing*.—Dull gray-brown, with traces of dark lines on costa; outer line at two-thirds curved, double, denticulate; cell spot large, dark brown; the whole of the central space below median, extending almost to base, filled with fuscous-brown scales; submarginal line pale, denticulate, preceded by a dark shade; fringe brown; subcostal space pale ochreous.

*Hindwing*.—Pale brown, much clouded with darker; the pouch-like space above dark and the pencil of hairs from base whitish.

Under side of forewing dull brown, with the cell spot and outer line dark; the pencil of hairs ochreous; hindwing brown, with the costal and apical area and the pouch blackish.

Head and prothorax pale ochreous; thorax and abdomen brownish; second segment with a broad blackish ring; the others marked with black.

*Expanse of wings*.—19 mm.

*Locality*.—Aroa, Venezuela; 1 male, 1 female.

The female is paler and has all the basal markings, as well as the others, distinct from costa to inner margin, and three lines on the hindwings.

*Type*.—Cat. No. 9289, U.S.N.M.

*DOCHEPHORA NUDATA*, new species.

*Forewing*.—Pale grayish brown, the subcostal vein narrowly ochreous; along the basal half of costa can be seen a dark curved line near base followed by a pale band, and three or four dark lines in the central fascia, none reaching below cell; a long, oval, blackish, scaled pouch between the median and first median nervule; at two-thirds, a dark pale-edged outer line, indented on vein 7, then outcurved before running inward, touching the outer end of the pouch to beyond middle of inner margin, followed by two more faint dark lines; submarginal line white, dentate, preceded by a dark shade; marginal line dark, interrupted; fringe brownish, mottled with paler, especially between veins 3 and 4, where the margin is also paler.

*Hindwing*.—Whitish, the inner margin broadly pale brownish, with traces of two dark lines and a dark marginal line; fringe white.

Under side of forewing dark gray, with the fascia marked on costa; inner margin whiter; the pencils of hairs white, base of pouch black-

ish, the outer half brown; hindwing pale with the apex broadly dark brown; traces of three cross lines.

Head, thorax, and abdomen like wings, but the head, shoulders, patagia, and basal segment of abdomen paler, more ochreous; a whitish streak across prothorax, and patagia, forming a pale spot at base of each forewing; forelegs fuscous in front; antennæ with blackish rings.

*Expanse of wings*.—25 mm.

*Locality*.—Chanchamayo, Peru; 1 male.

Very much like *D. pilosa* Warren from Costa Rica, but the hindwing beneath is entirely without the rough hairs with which *pilosa* is clothed. The pouchlike space on hindwing is not blackish, either above or below, and there seems to be no pencil of hairs from the base.

*Type*.—Cat. No. 9290, U.S.N.M.

#### DOCHEPHORA OBSCURATA, new species.

Female very much like the female of *D. fumosa* from Venezuela, but with the ground color darker and all the lines and markings less clearly defined; otherwise the descriptions given above of *fumosa* applies equally to the present species. On the under side, however, this species is in both wings very much darker than the same surface of *fumosa*, and I have no doubt that when the male is discovered it will be found to differ in like manner.

*Expanse of wings*.—19 mm.

*Localities*.—St. Jean, Maroni River; 1 female, April, 1904; 60 miles up the Maroni River, French Guiana, 1 female, August, 1904.

*Type*.—Cat. No. 9291, U.S.N.M.

#### Genus SEBASTIA Warren.

##### SEBASTIA ASSIMILIS, new species.

Exceedingly like *S. deldaria* Warren, described below; both sexes are slightly smaller and duller in coloration and markings; the face is whitish, always paler than in *deldaria*, the outer line is more oblique from the costa to the bend at vein 6; in *deldaria* this rises vertically and is bent outward below the subcostal; in both species the female wants the dark basal patch and central fascia, which characterize the male.

*Expanse of wings*.—16 mm.

*Locality*.—Cayenne, French Guiana; 1 male, 2 females, January, 1904.

A single female from Tijuca, Brazil, expands 18 mm. like *deldaria*, but agrees entirely with the Cayenne specimens in coloration and markings.

*Type*.—Cat. No. 9292, U.S.N.M.

**SEBASTIA BALTEATA, new species.**

*Forewing*.—Grayish white, the markings olive-gray, forming dark bands separated by clear pale spaces; basal patch small; pale band following it with a gray patch on costa; central fascia edged by olive-gray bands of two lines separated by a middle pale space with a curved line down it; an olive-gray band before the pale submarginal line; marginal line dark, interrupted at the veins; fringe checkered.

*Hindwing*.—With all the markings reproduced, except the basal ones; in the male with the costal half whitish, without markings.

Under side paler; all the markings more distinct, the ground color being less dusted; pencil of hairs of forewing of male white; the pouchlike swelling of hindwing long and colored like the rest of wing, apparently without pencil of hairs beneath.

Head, thorax, and abdomen like wings, the last with dark wings; patagia with basal half pale, outer half olive-gray, blackish in middle.

*Expanse of wings*.—17 mm.

*Locality*.—Orizaba, Mexico; 1 male, 1 female.

Superficially much like the type species *S. maleformata* Warren, from Brazil.

*Type*.—Cat. No. 9293, U.S.N.M.

**SEBASTIA DELDARIA, new species.**

*Forewing*.—Male, grayish fawn-color in outer half of wing, the basal area and upper half of central fascia filled with dark fuscous scales; lines darker; basal line close to base angled on median, slightly paler-edged; inner edge of central fascia at one-third, angled just before the black cell spot; outer edge at three-fifths, angled on vein 6; the band beyond fascia and the lower half of the fascia itself paler; submarginal line waved, pale, inwardly darker edged; an interrupted black marginal line; fringe dark, checkered with paler.

*Hindwing*.—With all the lines repeated in inner marginal half; the costal half white, the long oval pouch filled with black scales.

Under side whitish gray, with the lines dark gray, the outer line black on costa of forewing; inner margin of forewing glossy white, the pencil of hairs white, hindwing at base a shorter tuft of bright red hairs; costal pouch of hindwing clothed with darker gray scales.

Head, collar, and basal half of patagia pale ochreous; shoulders, thorax, and abdomen dark and light gray; antennæ thickened, strongly ciliated.

*Expanse of wings*.—17 mm.

*Locality*.—São Paulo, southeastern Brazil; 1 male, 1 female.

The female is fawn-colored throughout, without the dark basal shadings of the male, the upper part of central fascia alone being more strongly outlined. The lines are all equally plain across both wings and more distinct than in the male.

*Type*.—Cat. No. 9294, U.S.N.M.

**SEBASTIA DORMITA**, new species.

*Forewing*.—Male brownish cinereous, crossed by a series of darker lines, all oblique, parallel to hind margin below the bend in and beyond cell, and all thicker and darker on costa; the outer line, which is more strongly marked than the rest, and the line bordering the pale band beyond it, are both strongly indented inward below the subcostal vein, which, as well as the median, is slightly brownish tinged; submarginal line dull whitish, denticulate, connected by dark lines with the black dashes along margin between the veins; fringe brown-gray, in basal half checkered with paler, altogether pale in the apical half.

*Hindwing*.—With the markings repeated below the middle, but fainter; upper half whitish ochreous, without dark scaling; the pencil of hairs lying along lower margin of costal cavity deep yellow.

Under side pale grayish ochreous, with all the markings dark gray and distinct; pencil of hairs of forewing ochreous, yellower at tips.

Male, with hindwing normal; the cell spots distinct.

Head, thorax, and abdomen like wings.

*Expanse of wings*.—Male, 18 mm.; female, 20 mm.

*Locality*.—Castro, Parana, Brazil; 4 males, 2 females.

*Type*.—Cat. No. 9295, U.S.N.M.

**SEBASTIA HUMERATA**, new species.

*Forewing*.—Male, olive-ochreous, with dark olive-gray shading; a short black line close to base, marked by a deep black dot on costa and followed by a curved shade; a dark curved, somewhat crenulate line followed by a diffuse shade before the black cell spot, and a similar outer shaded line at two-thirds, followed by a pale band with dark thread along it; submarginal line pale, regularly waved, preceded by a double denticulate shade of smoky-fuscous, and followed by a band of same color reaching the dark marginal dashes; fringe mottled light and dark.

*Hindwing*.—With similar shades on the inner half of wing, the upper half whitish without markings; the costal cavity without tuft of hairs.

Under side pale whitish ochreous, with the dark gray shades distinct, especially the cell spots and outer line at costa; tuft of forewings pale whitish ochreous.

Head, thorax, and abdomen like wings; the face and prothorax rather paler; thorax and abdomen with dark streaks. The female is larger, greener, with a violet tinge along cell of wings.

*Expanse of wings*.—Male, 16 mm.; female, 24 mm.

*Locality*.—São Paulo, southeastern Brazil; 1 male, 1 female.

Resembling *S. dormita* in coloration; distinguished by the dark curved shades instead of oblique lines, also by a slight shoulder on costa of forewing at two-thirds marked by a few rough hairs.

*Type*.—Cat. No. 9296, U.S.N.M.

**SEBASTIA OLIVARIA**, new species.

*Forewing*.—Olive-green, clouded with black; the lines blackish and diffuse; a line close to base and the usual inner line beyond, both broad, angled in cell; cell spot black in a pale central space of ground-color, followed by an oblique diffuse shade; submarginal line minutely waved, running close to margin; marginal line dark, interrupted at the veins; fringe olive, with dark checkering.

*Hindwing*.—With six lines and shades, the third at middle, broadest.

Under side dull olive, with oblique broad postmedian and submarginal dark shades.

Head, thorax, and abdomen olive; the thorax, patagia, and metathoracic tuft, with a large admixture of black scales; abdomen with segmental rings and dorsal points black.

*Expanse of wings*.—22 mm.

*Locality*.—Ecuador; 1 male.

Both wings are narrow and elongate; the hindwing has the costal shoulder containing the cavity beneath much less prominent than usual, the cavity itself longer and covered with a plain flap, without tuft of hairs; the tuft of hairs on forewing and the hollow in which it lies is shorter than usual.

*Type*.—Cat. No. 9297, U.S.N.M.

**SEBASTIA PALLIDISTRIGA**, new species.

*Forewing*.—Pale ochreous, covered with dull gray and fuscous shading, the only distinct pale areas being a subcostal streak and the curved band beyond outer edge of central fascia; the usual lines can be faintly traced, the outer edge of central fascia especially being dark and forming a blotch beyond cell; the cell spot is large and dark.

*Hindwing*.—With the outer band pale, and the costal area ochreous, without markings.

Under side dull ochreous with gray markings; the pencil of hairs of forewing pale, and the pouch of hindwing unicolorous.

Head and shoulders and anal segments of abdomen pale ochreous, thorax and rest of abdomen dark olive-gray.

*Expanse of wings*.—15 mm.

*Locality*.—Orizaba, Mexico; 2 females.

Neither specimen is in good condition, and the description above given is necessarily defective, but the points emphasized will be enough to distinguish the species; the forewings appear narrow.

*Type*.—Cat. No. 9298, U.S.N.M.

Genus *TEPHROCLYSTIA* Hübner.*TEPHROCLYSTIA ANITA*, new species.

*Forewing*.—Earthy brown; lines thick, black, not continued below the median veins; basal area small, ochreous, shaded with reddish orange, edged by a black line; central fascia limited by thick curved black lines, the space between yellowish, tinged with orange; on each side a paler band with dark central line, the outer one edged on costa externally by a black streak; submarginal line hardly visible, marked by a pale spot between veins 3 and 4 and one at anal angle; marginal line black, with pale spots at the ends of the veins; fringe brown.

*Hindwing*.—With an indistinct dark curved central line followed by a paler band; traces of two dark lines toward base.

Under side cinereous, with the markings darker; the outer line blackish at costa; submarginal line marked by a complete series of pale spots.

Head, thorax, and basal segment of abdomen yellowish, with orange speckling; abdomen dark brown; the anal segments pale gray.

*Expanse of wings*.—Male, 16 mm.; female, 17 mm.

*Localities*.—Castro, Parana, Brazil; 1 male, 1 female; Jalapa, Mexico, 1 female.

*Type*.—Cat. No. 9299, U.S.N.M.

*TEPHROCLYSTIA ANTARIA*, new species.

*Forewing*.—Gray, dusted with darker and toward costa also with a few paler scales; the veins marked with short black dashes at the crossing of the lines which are obscurely marked otherwise; the outer edge of the central fascia is more distinct, bluntly angled on veins 6 and 4, beyond which the pale band is distinct, especially at the middle of wing; marginal line black, interrupted at veins; with short blackish streaks to the teeth of the submarginal line; cell spot black; fringe dark and light gray.

*Hindwing*.—Pale gray, whitish toward costa, with all the lines darker gray, especially on inner margin; the marginal area gray; cell spot black.

Under side luteous-gray, with all the lines and shades darker; cell spots black.

Head, thorax, and abdomen gray; dorsum rather darker.

*Expanse of wings*.—19 mm.

*Localities*.—São Paulo, southeastern Brazil; 1 female; Castro, Parana, Brazil; 1 female.

*Type*.—Cat. No. 9300, U.S.N.M.

## TEPHROCLYSTIA COLLINEATA, new species.

*Forewing*.—Pale gray, mixed with luteous, irregularly dusted with dark spots, the lines all marked by darker gray scales; oblique inward and flexuous, parallel to hind margin, below the bend in cell and on vein 6; the inner and outer edge of the central fascia and a middle line bent just beyond the dark cell spot being most conspicuous; the intervals between them, as well as the two pale bands on each side, with fainter gray lines; the gray band preceding the pale, somewhat blotched, submarginal line edged on both sides with dark scales; marginal line blackish, interrupted on the veins; fringe mottled pale and dark grey.

*Hindwing*.—Whitish, pale gray along inner margin, with all the lines dark gray, but fading out toward costa.

Under side smooth without dusting, dull whitish; the outer lines thick and well marked, as well as the cell spot and costa of forewing.

Thorax and abdomen gray, third segment of the latter with a dark belt; head and palpi whitish gray.

*Expanse of wings*.—Male, 17 mm.; female, 19 mm.

*Locality*.—Castro, Parana, Brazil; 2 males, 1 female.

*Type*.—Cat. No. 9301, U.S.N.M.

## TEPHROCLYSTIA CONDUPLICATA, new species.

*Forewing*.—Whitish gray, with dark gray speckling and suffusion; the costa luteous; the lines blackish, all geminate; basal line preceded by blackish shading, the outside edge of which is strongly angled on both folds, the outer arm of the basal lines similarly acutely angled; an oblique, thick median shade before middle, the outer arm lunulate and obscured; outer line at three-fourths dark and strongly dentate, followed by an equally dentate pale band traversed and limited by a dark line; submarginal line wavy, whitish, preceded by a dark gray shade slightly luteous-tinged, like the veins toward hind margin; marginal area pale gray, with a whitish space between veins 3 and 4, and at anal angle; a black marginal line, interrupted at the veins; fringe whitish, mottled with gray.

*Hindwing*.—Whitish; a dark gray shade at one-third and a second beyond two-thirds, both inwardly diffuse, with two faint gray lines between them; the outer also followed by a dark line, before a strongly zigzag submarginal one; marginal line and fringe as in forewing.

Under side grayer, with the lines all marked, but less clearly.

Thorax and abdomen luteous-gray, with blackish speckling; head, shoulders, and patagia luteous whitish; palpi dull yellow.

*Expanse of wings*.—22 mm.

*Locality*.—Jalapa, Mexico; 1 female. Near *T. dentosa* Warren from Ecuador, but grayer.

*Type*.—Cat. No. 9302, U.S.N.M.

## TEPHROCLYSTIA CONSORS, new species.

*Forewing*.—Dark fawn-color, overlaid in basal three-fifths with black lines and a mixture of black and white scales; basal patch sharply angled outward in cell and on submedian fold; inner edge of central fascia black, oblique, straight outward to middle of cell, and touching the black cell spot, there acutely angled and oblique inward; the band preceding more clearly fawn-color, outer edge nearly vertical, projecting slightly at vein 6, and clearly angled on submedian fold; it is preceded by two or three obscure blackish lines; submarginal line waved, white, preceded by a black shade which forms a double black blotch between 4 and 6, connected with central fascia by a patch of whitish scales, and an angled black mark before a white spot on submedian fold; externally it is edged with black and connected by black lines with the black interrupted dashes of the marginal line; fringe brown, mottled with darker beyond the veins.

*Hindwing*.—Fawn-color, with an olive tinge and without any black suffusion; a straight wavy blackish postmedian line preceded by three lines at equal distances apart; a marginal deeper shade, separated from it by a pale band and containing the indistinct dentate submarginal line.

Under side shining pale gray, with concisely curved darker bands; area from base to outer line darker, the line distinct and black at costa; cell spots black; band before submarginal line darker; base of costa of forewing blackish.

Face and vertex fawn-color; palpi and thorax blackish; abdomen dark fawn, with blackish dorsal tufts, a blackish ring on second segment, and black lateral lines; anal tuft white.

*Expanse of wings*.—22 mm.

*Locality*.—Orizaba, Mexico; 1 male.

This species must be allied to *T. cercina* Druce, also from Mexico, and it is possible that in a long series both forms might be united.

*Type*.—Cat. No. 9303, U.S.N.M.

## TEPHROCLYSTIA DEFIMBRIATA, new species.

*Forewing*.—Gray, with a slight luteous tinge along cell; the lines darker, but very fine; basal area darker gray, crossed and limited by a dark line; the band following pale with a dark gray thread; bands edging the central fascia dark gray only on costa, where they form square blotches, the outer edge lunulate-dentate, the teeth pointing inward, the lines preceding it marked darker on veins; cell spot blackish; band beyond gray, with a dark thread; outer margin dark gray, traversed by a pale gray lunulate submarginal line, the lunules filled up with blackish; marginal dashes black between the veins; fringe mottled dark and light gray, the outer half much paler.

*Hindwing*.—Paler, more luteous, the outer lines all marked, but less distinctly; fringe wanting; the margin appearing as if burnt, strongly protuberant below middle, slightly indented beyond cell and submedian fold.

Under side gray with the lines all dark gray, the outer line blackish.

Head, thorax, and abdomen gray, dorsum with blackish markings; anal tufts ochreous.

*Expanse of wings*.—18 mm.

*Localities*.—Castro, Parana, Brazil; 2 males. I have seen several examples from Huacabamba, Peru. Distinguished at once by the fringeless hindwing of the male.

*Type*.—Cat. No. 9304, U.S.N.M.

**TEPHROCLYSTIA DISCIPUNCTA, new species.**

*Forewing*.—Bone-color, with the lines luteous-gray; these are slightly marked toward base, first close to base, second at one-fourth, obliquely curved inward; outer line plainer at two-thirds; marginal area gray, separated into two gray bands by the continuous pale submarginal line; cell spot dark, distinct; marginal line dark; fringe, like wings, with dark spots at veins.

*Hindwing*.—Without inner line; marginal area darker.

Under side similar; the cell spots large and conspicuous.

Head, thorax, and abdomen bone-color; the face and palpi with a yellowish tinge.

*Expanse of wings*.—16 mm.

*Locality*.—Orizaba, Mexico; 1 female.

Superficially, this species might easily be mistaken for a *Ptychopoda*.

*Type*.—Cat. No. 9305, U.S.N.M.

**TEPHROCLYSTIA GAUMARIA, new species.**

*Forewing*.—Pale brownish gray, the lines darker gray alternating with paler lines, which beyond the middle, that is, in the outer half of central fascia and the pale band beyond, form white dots alternating with black ones on the veins; submarginal line wavy, pale; marginal black dashes between the veins; fringe gray with two dark lines; cell spot black.

*Hindwing*.—Similar, the pale and dark markings larger, partly sagittate.

Under side gray, with the outer lines and alternating dots very distinct.

Head, thorax, and abdomen speckled like wings.

*Expanse of wings*.—22 mm.

*Locality*.—São Paulo, southeastern Brazil; 1 female.

This species bears a strong resemblance to the common *T. vulgata* Haworth.

*Type*.—Cat. No. 9306, U.S.N.M.

**TEPHROCLYSTIA GOSLINA, new species.**

*Forewing*.—Pale lilac; the markings dark olive-fuscous; a basal patch, not reaching below median vein; a sinuous central fascia, with paler center, its inner edge deeply indented in cell from one-third of costa to before one-third of inner margin; its outer from two-thirds of costa to two-thirds of inner margin; curved throughout and indented slightly below median vein; a dark shade before the submarginal line which is very obscure; a black cell spot touching the inner edge at the end of the indentation; fringe lilac.

*Hindwing*.—The same, but without any basal patch; the inner edge of fascia straight.

Under side paler, whitish lilac; cell spots and outer lines blackish.

Head, thorax, and abdomen lilac; middle segments of dorsum dark.

*Expanse of wings*.—Female, 17 mm.; male, 16 mm.

*Localities*.—Jalapa, Mexico; 1 female, type; Cayenne, French Guiana, 1 male, January, 1904.

The female from Jalapa has been described as the type, being in good condition; the male, though from a distinct locality, is certainly the same species.

*Type*.—Cat. No. 9307, U.S.N.M.

**TEPHROCLYSTIA HASTARIA, new species.**

*Forewing*.—Fawn-color dusted with gray in the wide central area, including the fascia and the usually pale bands on each side of it, the extreme base also fawn-color; the outer half of the basal area, which is angled in cell, and the whole marginal area gray; in the central area all the usual lines can be seen but obscurely; the inner and outer bands or the fascia forming gray blotches on costa; in the gray marginal area a pale waved submarginal line; cell spot large and black; black marginal dashes between veins; fringe gray, darker along base.

*Hindwing*.—Dull pale gray, darker along inner margin and hind margin, with traces of lines along the former, and a dentate submarginal line before the latter; the fringe pale.

Under side of forewing pale cinereous, the lines marked only along costa, except the submarginal; cell spot black; hindwing pale gray, with three gray lines, the cell spot on the middle one; a waved gray submarginal line.

Head, thorax, and abdomen grayish fawn-color.

*Expanse of wings*.—21 mm.

*Locality*.—São Paulo, southeastern Brazil; 1 female.

*Type*.—Cat. No. 9308, U.S.N.M.

**TEPHROCLYSTIA HELENARIA, new species.**

*Forewing*.—Ground-color pale, but so densely covered with olive-fuscescent as to appear of that color, only the inner lines showing pale; basal small, edged by a dark line, outwardly paler; inner line from before one-third of costa, angled in cell, then oblique inward to one-fourth of inner margin, edged inwardly with paler; outer line at two-thirds, hardly bent below costa, then oblique, edged outwardly by a broad line of cream-color; submarginal line curved, pale, insinuate on submedian fold, cell spot dark; in the central area three dark cross lines are traceable, and sometimes two beyond outer pale line; marginal dark line interrupted; fringe checkered light and dark brown.

*Hindwing*.—With all the markings repeated but fainter, and without basal line; the submarginal obscurely denticulate.

Under side paler and brighter; the margins of central fascia and the cell spots blackish and diffuse; costa of forewing with dark shades.

Head, palpi, center of thorax and dorsum cream-color; shoulders and patagia, a lateral streak on abdomen, and a ring on basal segment blackish; legs and abdomen beneath all cream-color.

*Expanse of wings*.—17–19 mm.

*Locality*.—Brazil; 2 females; one, the type, from São Paulo, the other from Castro, Parana, Brazil.

*Type*.—Cat. No. 9309, U.S.N.M.

**TEPHROCLYSTIA INDECISA, new species.**

*Forewing*.—Cream-color, suffused with olive brownish; basal patch brown, its edge bent in cell, crossed by a pale line, and followed by a pale band with dark traversing line; central fascia with its edges broadly brown, divided above middle to costa by a pale patch of ground-color traversed by a brown line; pale band following clearest on costa; submarginal line fine, wavy, dentate, followed by a pale patch between veins 3 and 4; marginal line dark brown interrupted at the veins; fringe cream-color, brown beyond veins; the subcostal vein broadly cream-color, the median narrowly.

*Hindwing*.—Without the basal markings; the pale intervals broader and the dark bands restricted and grayer; submarginal line sharply dentate; the veins pale olive-brown toward margin.

Under side ochreous, with forewing much suffused with gray; all the lines fuscous; the outer edge of central fascia and shade preceding submarginal line conspicuous.

Head and thorax brown, the vertex and a broad band across prothorax white; abdomen with a brown band at base, the rest gray.

*Expanse of wings*.—26 mm.

*Locality*.—Jalapa, Mexico; 1 male.

The antennæ possess to each joint pairs of slender fascicles of cilia.

*Type*.—Cat. No. 9310, U.S.N.M.

**TEPHROCLYSTIA INFREQUENS, new species.**

*Forewing*.—With the basal area for nearly half of wing and the marginal area greenish gray; the outer half of central fascia fawn-color; the lines across the basal and central areas indistinct; the pale band following the fascia closely followed by the pale submarginal line, so that there appear to be three pale lines separated by two gray ones; cell spot black; marginal dashes between the veins; fringe greenish gray, darker and mottled on basal half.

*Hindwing*.—Whitish, grayer along inner and hind margins, with traces of gray lines across wing, most distinct on inner margin; a small cell spot.

Under side of forewing rufous-gray, with all the lines well marked, cell spot black; hindwing whiter, with a black cell spot followed by a dark gray postmedian and submarginal lines.

Head, thorax, and abdomen fawn-color mixed with gray.

*Expanse of wings*.—20 mm.

Female without locality.

Much resembles *T. hastaria*, described above, but the disposition of the tints is different, as well as the markings of the under side.

*Type*.—Cat. No. 9311, U.S.N.M.

**TEPHROCLYSTIA KURTIA, new species.**

*Forewing*.—Dark powdery gray, dusted with blackish, on a pale ochereous ground, which shows slightly only as pale bands edging the central fascia and as an oblique blotch at middle of costa containing the black cell spot; the pale bands have each a dark line along their middle; between veins 3 and 4 from lower end of cell a dull fuscous streak extends to hind margin; submarginal line pale, acutely dentate, preceded by a dark shade; fringe brownish mottled with dark gray.

*Hindwing*.—Without the basal markings; the pale spaces much wider and on the dark shades narrower and clearer; the fulvous streak broader; veins dotted with black.

Under side pale ochreous, with all the lines and shades dark gray and well marked; cell spots black.

Head, thorax, and abdomen all dark fuscous.

*Expanse of wings*.—22 mm.

*Locality*.—Orizaba, Mexico; 2 females.

Owing to the rough scaling the wings have a furry, somewhat greasy appearance.

*Type*.—Cat. No. 9312, U.S.N.M.

**TEPHROCLYSTIA LEUCOGRAPHATA, new species.**

*Forewing*.—Fuscous-brown, darker along the costa; lines bone-color, thick and distinct; first, near base, limiting the basal patch; second, at one-third; outer, at three-fourths; all angled in cell, then inwardly

oblique; a large brown cell spot; a blackish blotch on costa beyond outer line before apex; fringe worn, fuscous.

*Hindwing*.—Without inner line; the rest as in forewing.

Under side pale, dusted with brownish.

Head, thorax, and abdomen like wings, but the dorsum darker fuscous.

*Expanse of wings*.—16 mm.

*Locality*.—Jalapa, Mexico; 1 male.

*Type*.—Cat. No. 9313, U.S.N.M.

**TEPHROCLYSTIA MEDIOBRUNNEA, new species.**

*Forewing*.—Pale pinkish brown, dusted with black; the costa clouded with black, narrowly at base, more broadly at apex, and filling up the central fascia above the median vein; the lines very obscurely marked and plain, not on inner margin; submarginal line fine, very indistinct, preceded by a dark shade; marginal line blackish; fringe brownish.

*Hindwing*.—With the inner margin half clouded with black, showing the commencement of lines; the costal half pale brownish, with a small dark cell spot; marginal line black, interrupted; fringe brownish, toward anal angle and along inner margin blackish.

Under side with more of an olive tinge; the lines marked, but indistinct.

Head, collar, and abdomen black; thorax and basal segment of abdomen pale flesh-color.

*Expanse of wings*.—16 mm.

*Locality*.—Orizaba, Mexico; 1 male, 1 female.

Hindwing protuberant at veins 3 and 7, indented beyond cell. Allied to *T. seminigra* Warren, in which, however, the whole of the hindwing is black.

*Type*.—Cat. No. 9314, U.S.N.M.

**TEPHROCLYSTIA MOLLITA, new species.**

*Forewing*.—Brownish ochreous in basal and marginal areas, the central fascia dark gray; its inner edge curved at costa, then straight to one-third of inner margin, its outer edge angled on vein 6, then oblique to middle, then again projecting; cell spot blackish, above a streak of brownish ochreous scales along the median vein; in the basal area are a dark gray line close to base and a double darker brown line or band, both darker gray on costa; the central fascia is followed by a pale band with darker middle line; submarginal line very obscure, preceded on costa and above inner margin by a dark gray cloud; a dark gray marginal cloud beyond cell; marginal line black, thick, interrupted at the veins; fringe brown, mottled with gray.

*Hindwing*.—Brown, almost wholly suffused with dark gray; a gray cell spot and broad postmedian curved band; submarginal line waved, brownish, apparently double.

Under side pale ochreous, the lines thick, dark gray; cell spots and marginal lines thick; inner marginal half of forewing to beyond middle clouded with gray, apex of forewing brownish.

Head and collar dark gray; abdomen the same; thorax and basal segment of abdomen brownish ochreous.

*Expanse of wings.*—17 mm.

*Localities.*—Orizaba, Mexico; 1 female, type; Oaxaca, Mexico, 1 female.

Somewhat resembling *T. mediobrunnea* from the same locality, but the markings are slaty gray, rather than black. In that species the head and abdomen are quite black, and the thorax and base of abdomen very pale ochreous. In the female from Oaxaca the brown basal and marginal areas are visibly united by a streak along the median vein.

*Type.*—Cat. No. 9315, U.S.N.M.

**TEPHROCLYSTIA MUSCISTRIGATA, new species.**

*Forewing.*—Pale gray, with darker gray lines and markings, with an admixture in places of greenish yellow scales; lines oblique below the subcostal bend; a short dark basal line; the pale band following with a darker center on costa; central fascia consisting of an inner and outer band, each formed of three gray lines, distinctly separated by a pale band, the lines marked with blackish scales; the outermost line marked with black vein dashes and angled on veins 6 and 4; the traversing line of the pale band following is marked by dark vein dots; submarginal line pale, slightly waved, preceded by a dark shade, which is broadened and blacker at costa and on inner margin; marginal line formed of distinct black dashes separated by white spots at end of veins; fringe mottled, pale and dark gray.

*Hindwing.*—With the shades and lines reduced, paler gray.

Under side whiter, smoother, with the lines appearing at curved gray bands.

Thorax and patagia gray with a darker transverse line; shoulders and head pale ochreous, the palpi yellower; basal segment of abdomen gray, second with a broad black band, rest of abdomen pale ochreous, with black lateral streaks.

*Expanse of wings.*—25 mm.

*Locality.*—Castro, Parana, Brazil; 2 females.

Allied to *T. conduplicata* described above, but without distinct markings.

*Type.*—Cat. No. 9316, U.S.N.M.

**TEPHROCLYSTIA PARCIRUFA, new species.**

*Forewing.*—White, in parts suffused with gray, and covered with black points on the veins at the crossing of the lines; central fascia with the outer band black, indented below costa and stopping short at

vein 3, the lower part incurved and gray; the inner band dark gray; the pale band across its middle, like those preceding and following it, whiter with a gray central line; submarginal line white, dentate at costa, waved below, preceded by a dark gray shade which is black on costa and across submedian interval forms a black blotch, with the margin beyond it also black; a black marginal line; fringe white, double, with two gray shades darker beyond veins, the base and a middle line white; on subcostal vein at base, on median vein at inner edge of fascia, on vein 6 beyond outer line, and on vein 7 before submarginal line a few red scales.

*Hindwing*.—White, the inner margin, below median and vein 2, marked with six thick gray lines which are more or less obsolete beyond; cell spot black; fringe white, black mottled.

Under side of forewing gray, the markings plain only in the costal half; of hindwing white, with the markings plain throughout, the lines dotting the veins; cell spot black.

Head, thorax, and patagia white with a few dark scales; thorax and abdomen blackish; sides of abdomen reddish.

*Expanse of wings*.—27 mm.

*Locality*.—Cillate, Bolivia (Garlepp); 1 female.

In some ways this species approaches *T. rubellicincta* Warren from Peru, but it is narrower in the wing, and the hindwing almost without markings.

*Type*.—Cat. No. 9317, U.S.N.M.

**TEPHROCLYSTIA PEROLIVATA, new species.**

*Forewing*.—Dull olive-green, with slight black speckling; the lines indistinct; a short blackish line close to base; central fascia edged by darker olive bands formed of two or three lines separated by a pale band outcurved above and vertical below, traversed by a distinct olive line and containing on its inner edge the large black cell spot; submarginal line pale, waved, preceded and followed by a rather deeper shade; marginal line fine; fringe olive.

*Hindwing*.—With costal area paler; cell spot small, indistinct; the fascia very obscure; submarginal line distinct.

Under side paler; the cell spot black; the outer band of central fascia dark and prominent.

Thorax and abdomen like wings; head and shoulders pale ochreous; antennæ black; the segments angular, thickly ciliated.

*Expanse of wings*.—24 mm.

*Locality*.—Chaco, Peru; 1 male.

Allied to *T. brunneicosta* Warren.

*Type*.—Cat. No. 9318, U.S.N.M.

**TEPHROCLYSTIA PICTIMARGO**, new species.

*Forewing*.—Powdery gray, with a slight luteous or greenish tinge; lines very obscure, slightly darker; the outer and submarginal wavy dentate; cell spot large, blackish; a dark gray marginal line; fringe mottled pale gray; inner margin to submedian vein tinged with greenish luteous.

*Hindwing*.—Costal half whitish, without markings; inner and hind margins as in forewing; the luteous tint of inner margin broader, cell spot black.

Under side much paler; glossy; cell spot black; the lines all marked, but the outer line distinct and at costa of forewing blackish; marginal area dark gray.

Head, thorax, and abdomen luteous-gray.

*Expanse of wings*.—27 mm.

*Locality*.—Orizaba, Mexico; 1 female.

Very much like *T. cabira* Dognin in shape but with very indistinct markings; the luteous inner margin of both wings compared with the gray of the rest of the wing will serve to distinguish it; the subapical margin of hindwing between veins 6 and 7 projects squarely.

*Type*.—Cat. No. 9319, U.S.N.M.

**TEPHROCLYSTIA PLANIPENNIS**, new species.

*Forewing*.—Dark gray, with the lines faintly darker but indistinct; the outer line thick and plainer, the paler gray band beyond also distinct; submarginal line marked by a white spot on submedian fold; cell spot black and large; marginal line black; fringe dark gray.

*Hindwing*.—Without the basal lines.

Under side pale gray, with all the lines blackish and distinct, especially the outer line; cell spots black.

Head, thorax, and abdomen all dark gray.

*Expanse of wings*.—18 mm.

*Locality*.—Orizaba, Mexico; 1 female.

Distinguished by the uniform dark gray upper side.

*Type*.—Cat. No. 9320, U.S.N.M.

**TEPHROCLYSTIA RAUCA**, new species.

*Forewing*.—Male, greenish gray, thickly powdered with dark gray; the lines dark gray, or blackish; owing to the rough dark dusting all the markings are obscure, but the usual ones can be traced; the edge of the basal patch oblique at one-fourth; the inner band of the central fascia at two-fifths, and especially the outer band are visible as darker shades; this last forms a dark shade above middle; band before submarginal line dark on costa; the line itself waved and pale; a dark cell spot; fringe checkered dark and pale gray.

*Hindwing*.—With the lines somewhat clearer; the outer edge of central fascia complete across wing; the inner edge marked by a dark spot on inner margin.

Under side pale greenish gray, with the edges of central fascia black, the outer edge thick; the outer lines fainter; cell spot black.

Head, thorax, and abdomen like wings, but more thickly speckled with blackish; basal segment of abdomen blackish; lower part of face pale; abdomen with slight lateral tufts.

The male has the pale greenish tints more developed, the rough gray scaling being less.

*Expanse of wings*.—24 mm.

*Localities*.—Jalapa, Mexico; 1 male, type; Orizaba, Mexico; 1 female.

The peculiar greenish tinge is characteristic; the palpi are very long, rough haired; the antennæ of the male have long fascicles of cilia and the abdomen is long and large.

*Type*.—Cat. No. 9321, U.S.N.M.

**TEPHROCLYSTIA SELLIA, new species.**

*Forewing*.—Brownish fawn-color; basal area marked by a black-brown blotch along costa, edged by an angled whitish line at about one fourth; a large black-brown cell spot lying on a slightly curved but obscure brown shade; a black costal blotch before apex, preceded by a whitish comma-shaped blotch and followed by a dentate white streak, below which there is seen a submarginal line formed by a black spot between two white ones on each vein, and in the submedian space by a double white spot preceded by blackish scales; fringe brown.

*Hindwing*.—Paler brown; the inner margin crossed by seven or eight blackish lines, those toward anal angle black, separated by whitish scales.

Under side pale gray-brown; cell spot black; lines obscure except at costa of forewing; a blackish blotch at anal angle of hindwing.

Head, thorax, and abdomen fawn; dorsum with a pale central line; second segment whitish with four brown spots, two dorsal and two lateral; the third segment dark brown in front.

*Expanse of wings*.—18 mm.

*Locality*.—Orizaba, Mexico; 1 female.

This species is unlike any other that I have seen.

*Type*.—Cat. No. 9322, U.S.N.M.

**TEPHROCLYSTIA SEMILIGNATA, new species.**

*Forewing*.—Pale wood-brown; the basal and apical areas blackish gray; some shining white scales at the extreme base; basal patch small, black, edged by a pale line; the usual pale band following filled up with blackish scales; the inner edge of central fascia forming a

wedge-shaped mark toward cell spot, the outer edge only plain as a black blotch between subcostal and vein 4; vein 2 thickly blackish; the pale band beyond also only marked between the same veins; apical region blackish to costa; submarginal line dentate, white, continued across the brown area and marked with black scales at anal angle; marginal line black; fringe brown, checkered with gray.

*Hindwing*.—Wholly pale wood-brown; a dark gray band at base, a gray band beyond middle, the brown bands on each side of it with a dark line, and a dentate black white-edged submarginal line in the gray outer area.

Underside grayish ochreous; cell spots black; outer band of central fascia broadly blackish gray; the other lines well marked.

Head, thorax, and abdomen blackish; the last with alternate dark and light bands.

Under side and legs paler.

*Expanse of wings*.—22 mm.

*Locality*.—São Paulo, Southeastern Brazil; 1 female.

*Type*.—Cat. No. 9323, U.S.N.M.

**TEPHROCLYSTIA SEMIRUFESCENS, new species.**

*Forewing*.—Blackish, crossed by whitish ochreous lines; space between veins 2 and 4 from lower end of cell to hind margin smeared with fawn-color; basal patch crossed and followed by a waved white band with blackish center; the narrow inner dark band of central fascia separated from the broader outer band by a costal blotch of pale ochreous containing the black cell spot; pale band beyond with a thick middle line; submarginal line dentate, white, the teeth externally connected by black dashes with the marginal dashes; fringe fawn, dark mottled.

*Hindwing*.—With the fawn-colored streak developed and including the pale postmedian band; the inner half of wing blackish speckled; the veins dotted black and pale.

Under side pale ochreous, with all the lines and shades very distinct, blackish gray; cell spots black; the dark marginal area interrupted between veins 2 and 4.

Head, thorax, and abdomen blackish; the dorsum tinged with fawn.

*Expanse of wings*.—20 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

Antennæ strongly ciliated.

*Type*.—Cat. No. 9234, U.S.N.M.

**TEPHROCLYSTIA SUBALBA, new species.**

*Forewing*.—Sandy-ochreous, thickly gray dusted; the lines very obscure; the two pale bands with their dark central line on each side of central fascia are both plain; also a small dark cell spot and dark marginal thick dashes before the whitish fringe.

*Hindwing*.—White, dusted with sandy-gray along inner margin; the cell spot and marginal dashes blackish; fringe white.

Under side white, suffused in forewing with sandy-gray, and slightly in hindwing toward base; cell spots and marginal dashes distinct.

Thorax, and abdomen dark sandy-gray; face and palpi pale ochreous.

*Expanse of wings*.—18 mm.

*Locality*.—Orizaba, Mexico; 1 female.

The hind margin of hindwing is insinuate beyond cell and squarely projecting below apex between veins 6 and 7.

*Type*.—Cat. No. 9325, U.S.N.M.

**TEPHROCLYSTIA SUBMIRANDA, new species.**

*Forewing*.—Dingy olive-ochreous; the markings dull dark gray; consisting of a broad central fascia formed by four thick gray lines and containing a large blackish cell spot and a narrow marginal shade containing the dentate white-tipped submarginal line marked by a white spot above vein 1; fringe olive.

*Hindwing*.—Similar, the gray markings much duller.

Under side pale olive-buff; both folds silvery white; a gray cell mark and a similar mark obliquely below it on submedian fold; outer line marked by a curved row of black dashes on veins, followed by a velvety black marginal band across which the veins are snow-white.

Head, thorax, and abdomen above and beneath, and legs all olive-ochreous.

*Expanse of wings*.—18 mm.

*Locality*.—Geldersland, Surinam River, Dutch Guiana; 1 female.

The contrast between the upper and lower surface is remarkable.

*Type*.—Cat. No. 9326, U.S.N.M.

**TEPHROCLYSTIA SYLPHARIA, new species.**

*Forewing*.—Pale pearly gray; the lines alternately pale brown and gray; all very concise and parallel, marked on veins and folds by minute black scales; the outer and inner edge of central fascia rather more distinct and brownish, likewise the band preceding the pale submarginal line; cell spot large and black; marginal spots black, large; fringe pearl-gray.

*Hindwing*.—Whitish; the lines dark gray and distinct only along inner margin; the submarginal line complete and the margin gray.

Under side pale gray in forewing, white in hindwing; lines of forewing distinct only in costal half; hindwing powdered with dark gray at base and with all the lines blackish and clear; cell spots clear.

Head, thorax, and abdomen pearl-gray; abdomen with a brown and black belt on third segment.

*Expanse of wings*.—15–17 mm.

*Locality*.—São Paulo, southeastern Brazil; 2 females.

*Type*.—Cat. No. 9327, U.S.N.M.

## TEPHROCLYSTIA UVARIA, new species.

*Forewing*.—Dull pale brown, the costa, central fascia and anal region blackish, all with a slight greenish tinge; all the lines obscure, but well marked on the costa; central fascia broad, its edges oblique outward and angled in cell and on vein 6, then oblique parallel to hind margin, containing three dark lines of which the middle one is broadest; cell spot prominent, black, preceded by a white crescent; submarginal white, close to margin, with faintly darker edging; fringe brown.

*Hindwing*.—Brown, the inner marginal half dark fuscous, through which can be traced several faint pale transverse lines, especially the submarginal.

Under side brownish cinereous, with all the markings indistinct.

Head, shoulders, and base of patagia dark fuscous, the costal margin also, a broad ring on basal segment of abdomen; thorax, tips of patagia and abdomen pale brown; the last with a white dorsal stripe stopping short before anal segment.

*Expanse of wings*.—17 mm.

*Localities*.—São Paulo, southeastern Brazil, 1 male; Castro, Parana, Brazil, 1 female.

Allied to *T. magnipuncta* and *cupreata* Warren. The female has the wings browner, the black tints being softened down.

*Type*.—Cat. No. 9328, U.S.N.M.

## TEPHROCLYSTIA VIOLETTA, new species.

*Forewing*.—Violet-gray; toward the costa with a brown tinge; lines black; first close to base, curved; second at one-third, bent in cell; the band before it broad and varied with some gray and blackish scales; outer line at three-fifths; curved outward round cell; cell spot black; submarginal line indicated by a brown shade preceding it; an interrupted black marginal line; fringe gray.

*Hindwing*.—With a central black line from inner margin to lower end of cell, joining at an angle the black linear cell mark; submarginal shade as in forewing, marked at anal angle, as well as the obscure outer line, with black.

Under side pale gray; costa of forewing with dark commencements of lines; the cell spots and outer lines blackish.

Thorax and abdomen like wings; vertex, face, and palpi dull whitish.

*Expanse of wings*.—26 mm.

*Locality*.—Oaxaca, Mexico; 1 female.

The unique specimen is somewhat rubbed, but the species is very distinct and may be recognized by the dark angled line of hindwing.

*Type*.—Cat. No. 9329, U.S.N.M.

**TEPHROCLYSTIA WESTONARIA**, new species.

*Forewing*.—Greenish ochreous, thickly dusted with blackish scales, rendering the marking indistinct; there appear to be a small basal patch and central fascia with inner edge curved and outer edge bent outward in middle, then incurved, followed by a band of pale ground-color; toward outer edge of fascia is a smoky blackish shade preceded by the black cell spot; marginal area darker, traversed by an obscure paler submarginal line and with a pale spot between veins 3 and 4 on margin; fringe olive beyond a marginal series of black dashes.

*Hindwing*.—With parallel straight dark lines and shades.

Under side without the greenish ochreous shade; the ground-color whiter, the speckling grayer.

Head, shoulders, basal half of patagia, and abdomen greenish ochreous; apical half of patagia, metothorax, and basal segment of sides of abdomen blackish; in the male the dorsal points are blackish and the anal tufts of abdomen ochreous.

*Expanse of wings*.—Male, 16 mm.; female, 17 mm.

*Locality*.—Orizaba, Mexico; 1 male, 3 females.

Both wings narrow, with acute apex and hind margin only faintly curved.

*Type*.—Cat. No. 9330, U.S.N.M.

**Subfamily DEILINIINÆ.****Genus LOMOGRAPHIA** Hübner.**LOMOGRAPHIA DISCOLORATA**, new species.

*Forewing*.—White, with a faint gray discoloration toward hind margin with slight gray speckling; costal edge narrowly yellow to two-thirds, then broadened to apex; a gray lunulate-dentate outer line at two-thirds, and faint traces of an inner line at two-fifths; cell spot minute; faint gray dots on margin between veins; fringe pale gray.

*Hindwing*.—With traces of postmedian and submarginal lines.

Under side white, the costa of forewing yellowish.

Face and palpi dark brown; vertex, thorax, and abdomen white; legs yellowish.

*Expanse of wings*.—28 mm.

*Locality*.—Paraguay; 1 male.

*Type*.—Cat. No. 9331, U.S.N.M.

**LOMOGRAPHIA PROXIMATA**, new species.

*Forewing*.—Dull white, the costal edge grayish ochreous; lines gray, rather thick; first from two-fifths of costa to middle of inner margin; second from two-thirds of costa to beyond two-thirds of inner margin, slightly outcurved; third from four-fifths of costa to just before anal

angle; none of the lines actually reach the costa; cell spot minute, gray; marginal line fine; fringe white.

*Hindwing*.—With two lines, postmedian and submarginal, the latter more curved than the former, approximated on inner margin.

Under side white, somewhat glossy; costa of forewing yellowish.

Face and palpi brown-black; vertex, thorax, and abdomen white; legs white; forelegs fuscous in front.

*Expanse of wings*.—36 mm.

*Locality*.—Bolivia; 1 male.

Very near to *L. venata* Warren, but the veins are not darker; the lines are in a different position; the face is black, not whitish, and the costal edge is paler.

*Type*.—Cat. No. 9332, U.S.N.M.

#### LOMOGRAPHA ULTIMATA, new species.

*Forewing*.—White, costal edge pale brownish; the lines formed of gray dusting; the first most distinct on inner margin, at two-fifths, obscurely double; the outer at two-thirds, formed of two gray shades, obscurely lunulate-dentate; submarginal line single; marginal area gray speckled; black marginal lunules; fringe dark gray, this hue also running narrowly along hind margin before the marginal lunules; cell spot minute.

*Hindwing*.—Without inner line; fringe gray; no shade before margin.

Under side white; costa of forewing shining yellowish.

Face and palpi brown; vertex, thorax, and abdomen white; legs white, forelegs brown in front.

*Expanse of wings*.—26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

Close to *L. extremata* Warren, from Peru, but smaller; the outer line quite different.

*Type*.—Cat. No. 9333, U.S.N.M.

#### Subfamily PALYADINÆ.

#### Genus BERBERODES Guenée.

#### BERBERODES CASSITERIS, new species.

*Forewing*.—Male, hyaline white, toward anal angle with a brilliant silvery gloss; costa yellowish, with dense purple-gray spots and striae; three series of grayish ochreous spots on the veins, also marked on submedian fold; a narrow purplish gray border thinning out to anal angle, its inner edge consisting of ochreous-gray striae, and with a gray blotch at apex; darker wedge-shaped marks on veins, plainest toward costa, and some dark diamond-shape marginal spots between the veins; fringe concolorous with marginal border.

*Hindwing*.—With the whole outer two-thirds brilliant silvery; inner row of spots only shown as dark dots on median and submedian veins; the gray border narrower, running from apex to middle of margin only, with marginal diamond and gray fringe; fringe at anal angle consisting of coarse, rough spatulate hairs, protruding irregularly; beyond middle of inner margin a bed of coarse purple scales preceded by a tuft of long dark radiating scales.

Under side white, with the marginal border purple, thinned out on hind margin nearly to anal angle.

Head and thorax brown; shoulders and patagia white; abdomen ochreous; both thorax and abdomen are probably white when fresh.

Female without the silvery gloss; the hindwing with ochreous striations in outer half, here again the abdomen and legs are dirty brown, probably stained from white.

*Expanse of wings*.—27 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, 1 female, September, 1904.

In the male the hind margin of forewing is slightly bent at vein 4.

*Type*.—Cat. No. 9334, U.S.N.M.

#### BERBERODES? DELICATA, new species.

*Forewing*.—Female pale straw-color, semitransparent; cell spot metallic, black, transversely linear; just before it on costa a dark spot indicates a curved basal line; a sinuous lustrous violet line from apex follows or rather rests upon a broad purplish parallel band, both becoming brown below vein 3 and not reaching inner margin; marginal area brown; fringe yellow beyond cell, marked with purplish black above and below.

*Hindwing*.—With slight brownish band at base and broad marginal border, deeper at apex; two or three dark marginal spots at apex; fringe pale.

Underwing pale straw-color; forewing with black cell spot and broad purplish marginal border; hindwing with the border restricted to apical half of margin.

Head, thorax, and abdomen pale straw-color.

*Expanse of wings*.—17 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; November, 1904.

As the single specimen is a female, I leave it in *Berberodes*, but it will very likely form the nucleus of a new genus.

*Type*.—Cat. No. 9335, U.S.N.M.

#### BERBERODES SIMPLEX new species.

*Forewing*.—With the white ground obscured by violet-fuscescent suffusion and striae; the costa broadly yellow, with minute brown dots along the edge, with two white spaces projecting somewhat triangu-

larly into the darker suffused area, one before the cell spot, the other before the outer line; first line nearly vertical at one-fourth; second, beyond middle, and outer at three-fourths, both outcurved above and waved, the outer approximated to hind margin; veins toward hind margin darker; a row of black marginal lunules between veins; apex white, with dark speckling; cell spot large, brownish; fringe rufous-gray.

*Hindwing*.—Thickly striated with violet-fuscous, the white ground color showing more plainly; all three lines distinct, the inner and outer edged with white; an indistinct whitish submarginal line; basal half of inner margin and its fringe pure white.

Under side pinkish cream-color with a thick middle line and broad marginal border on both wings dark brown. Face and palpi bright ferruginous, speckled with white; shoulders and base of patagia white; vertex and collar gray-brown; thorax and abdomen like wings; abdomen below, pectus and legs cream-white.

*Expanse of wings*.—26 mm.

*Locality*.—Rockstone, Essequibo, British Guiana; September, 1904.

Although this species is described as a *Berberodes*, it should be noted that the male is evidently devoid of the distinguishing marks of the type species *B. condylata* Guenée; both fore and hind wings having a perfectly simple structure.

*Type*.—Cat. No. 9336, U.S.N.M.

#### BERBERODES VIOLACEA, new species.

*Forewing*.—Brownish fuscous; at base and along costa bronzy-black; the three lines are only just traceable, vertical and wavy, at even distances apart; also a dark cell spot; fringe concolorous.

*Hindwing*.—Brownish fuscous; the amplified flap of the inner margin from base to anal angle, together with the fringe, bronzy-black.

Under side of both wings deep violet, the margins diffusely darker; the bed of rough hair scales at margin on the submedian interspace of hindwings blackish.

Thorax and abdomen bronzy-violet; lateral wisps of hair on abdomen black; head, collar, and palpi deep yellow.

*Expanse of wings*.—23 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; October, 1904.

*Type*.—Cat. No. 9337, U.S.N.M.

#### Genus CIRRHOSOMA Warren.

#### CIRRHOSOMA CURVATA, new species.

*Forewing*.—White, semihyaline; costa gilded yellow, with slight purple speckling; three obscure ochreous-gray lines at one-half, one-fourth, and three-fourths, parallel to margin, the outer indistinctly

lunulate-dentate; marginal area filled with ochreous striæ, a slight dark marginal line; fringe white.

*Hindwing*.—Without the inner line.

Under side shining white; costa of forewing yellowish.

Head and antennæ brown; thorax and abdomen white; dorsum tinged with brown at middle; the anal segment fuscous; legs yellowish; abdominal tufts white.

*Expanse of wings*.—30 mm.

*Locality*.—Jalapa, Mexico; 1 male.

Smaller than *C. translucida*; the hind margin of hindwing rounded, not angulated. The large abdominal tuft rises from the side of the fourth segment, more or less hiding smaller tufts from the next three segments.

*Type*.—Cat. No. 9338, U.S.N.M.

#### Genus GYOSTEGA Warren.

##### GYOSTEGA RUFIMACULA, new species.

*Forewing*.—Male, hyaline white; costa coppery-ochreous, spotted with blackish; a large coppery-red dark-edged semicircular blotch on inner margin before middle, with some coarse metallic purple scales along the margin; the three usual rows of spots in the single example, very obscure (probably worn); a broad grayish purple marginal border, its inner edge slightly undulating and marked with ochreous-gray; a slight whitish horizontal streak across it from apex along vein 8; fringe concolorous with border; fringe of inner margin white, except along the patch where it is purplish.

*Hindwing*.—With the border narrow and reaching only from apex to middle, the fringe beyond it purplish, below it white; fringe of hairs from upper margin of cell white; the tuft on discocellular gray; the lobe of inner margin with a bed of coarse metallic purplish scales.

Under side without markings except the brown marginal border; apex of forewing narrowly white; the costa yellowish; hindwing with a fringe of white hairs below the median vein and vein 2; fringe in the submedian interval, which is curtailed, grayish.

Head and collar purplish black; thorax white; abdomen fuscous above, at sides and underneath white, the anal segment beneath ochreous; pectus white; legs dingy gray.

Female without the red blotch on inner margin and with the three series of spots complete, the middle one ending on inner margin in a fulvous spot with black on the margin, as in *conchylata*, a line of gray striæ before the dark border; hindwing with two series of spots and gray striæ along the hind margin, forming a cloud at anal angle; apical border as in male; marginal dashes and the fringe gray.

Under side as in male but with a gray blotch at anal angle of hindwing.

Abdomen ochreous instead of fuscous.

*Expanse of wings*.—30 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, 1 female, September, 1904.

The discocellular of hindwing is very oblique in the male.

*Type*.—Cat. No. 9339, U.S.N.M.

Genus **HEMIPHRICTA**, new genus.

Allied to the group of genera including *Berberodes* Guenée and *Ballanliophora* Butler; forewing much narrower, hind margin far more obliquely curved, and the inner margin therefore shorter by comparison; the inner margin of hindwing longer; antennæ of male with sessile fascicles of cilia; hindwing of male beneath, except at base, clothed with rough curved scales; scaling otherwise very fine and glossy.

*Type*.—*Hemiphricta albicostata*, new species.

**HEMIPHRICTA ALBICOSTATA**, new species.

*Forewing*.—Bronzy olive-brown; the costal edge gilded yellow, with short purplish striations; below it a broad pearl-white subcostal streak from base of inner margin to apex, hardly interrupted at one-fourth, two-thirds, and five-sixths by brown transverse lines, of which only the submarginal can be traced as a very fine bluish white lunulate-dentate line to three-fourths of inner margin; dark marginal dashes between the veins; fringe concolorous; cell spot pearly white, half hidden by the subcostal streak.

*Hindwing*.—Deeper in color, more purplish bronze; the submarginal line only visible, as in forewing.

Under side of forewing iridescent pinkish cinereous, paler along costa and before a broad, dark marginal border; hindwing covered with rough curved brown scales, except along costa, which is broadly pearly lustrous.

Face, palpi, and vertex bright ferruginous; collar dark brown and ferruginous; shoulders and base of patagia pearly white; thorax and abdomen bronze-gray; pectus woolly, white; legs laterally fuscous.

*Expanse of wings*.—35 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; August, 1904.

*Type*.—Cat. No. 9340, U.S.N.M.

Genus **NEOZUGA**, new genus.

*Forewing*.—Costa straight, convex before apex which is blunt; hind margin hardly sinuous.

*Hindwing*.—Narrow; both angles and hind margin rounded.

Antennæ of male simple, filiform; palpi porrect, short, roughly scaled; tongue weak; frenulum present; hind tibiæ thickened, with four spurs, one much longer than the others.

*Neuration*.—Forewing, cell not quite half as long as wing; discocellular straight, oblique; first median nervule shortly before end of cell, second and third stalked; lower radial from a little below upper end of discocellular, upper from the end; 7, 8, 9, 10 stalked; 11 anastomosing with 12; hindwing, costal and subcostal anastomosing for three-fourths of cell; 6, 7, and 3, 4 long stalked; no radial.

*Type*.—*Neozuga strictifascia*, new species.

**NEOZUGA LATIFASCIA, new species.**

*Forewing*.—Purplish slate-color, the space between median and outer line olive-ochreous, which is really the ground-color; lines dark brown shading into velvety black; first close to base and second visible before middle, both somewhat interrupted; costa as far as outer line dull yellowish speckled with dark; outer line vertical at two-thirds, outcurved on vein 6 and again below middle, edged with pale ochreous; the pale space between middle and outer lines has a fine olive line across it close beyond middle line, and the whole outer half olive above median vein and outlined with blackish in the lower projection and on inner margin; submarginal line also doubly curved, preceded by an olive-brown shade and edged outwardly with ochreous; deep yellow marginal spots at the vein ends, and on costa before apex; fringe purplish gray.

*Hindwing*.—With three lines only, all preceded by dark olive-brown shading and edged with paler; the space between basal and middle line interruptedly ochreous.

Under side olive-fuscescent, with a broad uninterrupted yellow fascia before middle, narrower in hindwing; costa of forewing yellowish in places; base of hindwing yellow.

Head, thorax, and abdomen dark bronzy purplish; palpi ferruginous; collar and anal tuft yellowish.

*Expanse of wings*.—17 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; July, 1904.

*Type*.—Cat. No. 9341, U.S.N.M.

**NEOZUGA STRICTIFASCIA, new species.**

In coloration and markings exceedingly like the preceding species, *latifascia* but altogether a dingier insect; the ochreous median area with oblique inner edge; the outer line more oblique and with the projections stronger and more abrupt; the deep yellow marginal spot larger; in the hindwing the ochreous median area is altogether absent, suffused with purplish; in both wings the dark shades are more mixed with brown.

Under side with the deep yellow fascia at or beyond middle; that in the forewing oblique, broad at costa and narrowing to a point before anal angle; that on hindwing with the dark basal area projecting pointedly into it at middle.

The head, thorax, and abdomen bronzy-purple, but more varied with yellowish scales, especially along the sides of the abdomen.

The species differ also in shape of wing, the costa of forewing being more convex before apex and the anal angle somewhat lobed, so that the wing appears swollen at its end, and the inner margin sinuous instead of straight; there is no bed of furry hair on the under side of hindwing.

*Expanse of wings*.—21 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; July, 1904.

*Type*.—Cat. No. 9342, U.S.N.M.

Subfamily OURAPTERYGINÆ.

Genus PHRYGIONIS Hübner.

PHRYGIONIS FRATERCULA, new species.

*Forewing*.—Fawn-gray, with three yellow belts; first narrow, close to base and curved, externally edged with black and metallic scales; second just beyond, outwardly angled on median and submedian veins, edged on both sides with black and metallic scales; third from middle of costa to two-thirds of inner margin, irregularly wavy, and edged inwardly by a line of thick metallic scales, accompanied externally by a belt of cream-color, from which it is separated by a fine obscure line of leaden-color scales which are metallic only below costa; fringe concolorous.

*Hindwing*.—With the outer belt only, curved, and running from shortly before apex to just before anal angle; here the yellow inner arm is brighter and better defined and projects yellow black-edged rays along the nervures, which interrupt the metallic internal edging of the belt; the outer arm instead of being cream-color is buff, or rufous, separated from the yellow arm by an edging of black scales and followed by a strongly lustrous line, which in its upper half is succeeded by a diffuse red shading, a similar red shading also running along margin from apex to middle; before the blunt middle angle above vein 4 is an oblong blood-red blotch, the outer end of which is metallic silvery; below vein 4 a small red spot of which the broad outer edge is also metallic silvery; below vein 3 are traces of a minute similar spot.

Under side paler, with the outer belt showing dull yellowish.

Head, thorax, and abdomen concolorous with wings; the segmental divisions and tuft of the male abdomen yellowish.

*Expanse of wings*.—Male, 30 mm.; female, 34 mm.

*Locality*.—Santiago, Cuba; 1 male, January, 1903; 1 female, July, 1902.

*Type*.—Cat. No. 9343, U.S.N.M.

**PHRYGIONIS SORORCULA, new species.**

*Forewing*.—Olive-gray, without the fawn-colored tint of *fratercula*, to which it is closely allied; instead of the bright pale yellow markings, the typical pair have it dull and clouded with olive (one female alone agreeing with *fratercula* in having the yellow belt inclosed); they all agree in having the inner edge of the outer belt of forewing expanded baseward above middle so that the belt becomes funnel shaped, and the pale outer arm is either absent or narrow and inconspicuous; in the hindwing the rufous-buff outer arm is absent, the belt being followed closely by the lustrous line; there is no marginal red shading from apex to middle, but instead a submarginal dull lustrous streak; the red blotches are confluent externally and continued as a fine red line to anal angle, along which the dull streak from the apex is produced as a fine continuous metallic silvery line; the outer belt generally in the hindwing is more abruptly outcurved in the middle than in *fratercula*.

*Expanse of wings*.—Male, 32 mm.; female, 35–40 mm.

*Locality*.—Baracoa, Cuba; 1 male, January, 1903; 1 female, December, 1902; 1 female, August, 1902, the last being the yellow belted form.

Both *fratercula* and *sororcula* differ from other species in the yellow veins of the hindwings.

*Type*.—Cat. No. 9344, U.S.N.M.

**Subfamily NEPHODIINÆ.****Genus ASTYCHIA Druce.****ASTYCHIA SIGNATA, new species.**

*Forewing*.—Dingy hyaline gray, costal area above subcostal vein and marginal area opaque gray; veins, dark fuscous; discocellular marked by a blackish crescent; lines oblique, first from one-third of costa to one-fourth of inner margin very obscure; median thicker, lunulate-dentate, incurved on both folds; outer line thick at two-thirds below costa and broad beyond cell, then oblique and straight; submarginal most clearly marked, zigzag, joining outer line on inner margin; fringe gray.

*Hindwing*.—Without two first lines; the postmedian of uniform width, curved beyond discocellular in both wings, but more conspicuously in the hindwing, the margin between veins is narrowly paler, so that the gray border appears waved.

Under side the same, but the gray tints all darker, especially the postmedian line.

Head, thorax, and abdomen like wings, but the face and abdomen paler ochreous; legs, dark gray.

*Expanse of wings*.—40 mm.

*Locality*.—Carabaya, southeastern Peru; 1 male.

*Type*.—Cat. No. 9345, U.S.N.M.

Genus LEUCULOPSIS Warren.

LEUCULOPSIS INTERMEDIA, new species.

*Forewing*.—White, finely freckled with gray; costal edge pale yellow; a pale brown line from above apex to three-fifths of inner margin; fringe white.

*Hindwing*.—With the brown line central; a fine rusty gray marginal line.

Under side pure white.

Face, thorax, and abdomen white; palpi externally; vertex, base of antennæ, and a spot on front of fore tibiæ bright red.

*Expanse of wings*.—48 mm.

*Locality*.—Jalapa, Mexico; 1 female.

Intermediate, apparently, between *L. coanaria* Schaus and *L. colorata* Warren.

*Type*.—Cat. No. 9346, U.S.N.M.

Genus MYRMECOPHANTES Warren.

MYRMECOPHANTES VELATA, new species.

*Forewing*.—Smoky black, in basal half subtransparent; an elongated broad, dull white fascia from below two-thirds of costa to vein 2; fringe black.

*Hindwing*.—Smoky black, with broad central and marginal fasciæ deep black.

Under side dull brownish black; costa, apex, and hind margin of both wings dull olive-brown. In the hindwing the paler portions are all brownish and the veins black; the white fascia in forewing brighter.

Head and thorax black; abdomen grayer black; sides and bottom of face, a spot in middle of fillet, another in middle of prothorax, and a spot at side of shoulders white; pectus and under side of abdomen white, this latter with black line down center and black segmental rings; legs black.

*Expanse of wings*.—56 mm.

*Locality*.—Colombia; 1 male.

Nearest to *M. albifascia* Maassen.

*Type*.—Cat. No. 9347, U.S.N.M.

## Genus NIPTERIA Guenée.

## NIPTERIA DEFORMIS, new species.

*Forewing*.—Dirty whitish, semitransparent; the veins dull gray; the whole apical area dull smoky gray, thinning out to anal angle; inner line very indistinct, from one-third of costa to beyond middle of inner margin, only plain on costa and inner margin; a gray linear cell spot on upper half of discocellular; outer line thick, dark gray, outcurved from two-thirds of costa, and there much broader, to three-fourths of inner margin; fringe dull gray.

*Hindwing*.—Dirty whitish, with a few gray striations toward hind margin.

Under side of forewings dull whitish, with the outer markings present but faint; hindwing covered with gray striæ, with ill-defined broad central and submarginal bands dull gray; the veins dark.

Head, thorax, and abdomen dirty gray, like costa of forewing; lower part of face, base of palpi, pectus, and abdomen beneath whitish; terminal segment of palpi and antennæ black; legs externally fuscous.

*Expanse of wings*.—42 mm.

*Locality*.—Chanchamayo, Peru; 1 male.

*Type*.—Cat. No. 9348, U.S.N.M.

## NIPTERIA MARGINATA, new species.

*Forewing*.—Subtransparent, pale gray, with a few scattered black scales; the costal area above subcostal vein and more broadly beyond middle thickly black and white speckled; costal edge black; a slight dark cell mark at summit of discocellular; fringe dull blackish, paler below middle.

*Hindwing*.—Wholly gray; fringe, dark gray.

Under side of hindwing and costal and hind margin of forewing thickly black speckled; both cell spots black; in hindwing a submarginal black shade with the ends of veins black; in forewing a blacker subapical shade from costa to hind margin, leaving apex paler.

Thorax and abdomen dark gray; head and vertex black.

*Expanse of wings*.—40 mm.

*Locality*.—Salta, Argentina; 1 male.

Hind margin of forewing slightly bent at vein 4; of hindwing more visibly, as the margin is slightly indented before anal angle.

Nearest of *N. perimede* Druce and *N. excavata* Warren; distinguished by the unmottled fringe.

*Type*.—Cat. No. 9349, U.S.N.M.

## NIPTERIA SABULOSA, new species.

*Forewing*.—Hyaline cream-color, covered with pale olive-gray atoms partially confluent, those along costa and hind margin pale brownish;

two transverse lines of unspeckled ground-color, one at two-fifths, nearly vertical, the other oblique from four-fifths of costa to two-thirds of inner margin; fringe sandy-gray.

*Hindwing*.—Cream-color, without markings; a very fine marginal line; fringe concolorous.

Under side like upper, but in forewing the speckling only shows through, except along costa and hind margin.

Head and thorax like forewings; abdomen pale like hindwing.

*Expanse of wings*.—44 mm.

*Locality*.—Colombia; 1 male.

Nearest to *N. pellucida* and *pellucenta* Dognin.

*Type*.—Cat. No. 9350, U.S.N.M.

#### Genus SCORIOPSIS, new genus.

Differs from *Nepteria* and *Penthophlebia* in the median and submedian veins of forewing being quite straight, not bent at base; the foveal bar very faint; palpi short, porrect; forehead bulging; antennæ of male bipectinate.

*Neuration*.—As in *Nipteria*.

*Type*.—*Scoriopsis nigrivenata*, new species.

#### SCORIOPSIS NIGRIVENATA, new species.

*Forewing*.—Chalk-white; the costal edge and all the veins black; fringe white, with a black spot at the end of each vein; cell dot black.

*Hindwing*.—Similar, a minute black cell dot.

Under side like upper.

Head, thorax, and abdomen white; face, vertex, and sides of shoulders yellow; palpi and antennæ black; legs white, externally blackish.

*Expanse of wings*.—46 mm.

*Locality*.—Guadalajara, Mexico; 1 male.

*Type*.—Cat. No. 9351, U.S.N.M.

#### Subfamily BRACCINÆ.

#### Genus SANGALOPSIS Warren.

#### SANGALOPSIS MEDIATA, new species.

Wings brown-black; forewing with a large red blotch at middle; as in *ino* and *aloona* Theirry-Meig; this blotch below is bounded by the submedian vein, but for hardly 3 mm.; the top of the blotch, which is parallel to the costal edge and runs along the subcostal vein, also measures scarcely 3 mm., its inner extremity being 7 mm. from base and its outer 5 mm. from hind margin; the outer edge of the blotch is gibbous at middle, the inner nearly vertical, curving somewhat outward at top, and roughened beneath, this edge projects along the median vein. The red spot on sides of thorax at base of forewing is

present, but no lateral spots on abdomen, nor any blue sheen on forewing.

*Expanse of wings*.—30 mm.

*Locality*.—Bolivia; 1 male.

*Type*.—Cat. No. 9352, U.S.N.M.

Subfamily ASCOLINÆ.

Genus BRONCHELIA Guenée.

**BRONCHELIA BENEFICTA**, new species.

*Forewing*.—White, with coarse granular fuscous speckles, thickest toward base and hind margin and along the costa; the lines black, all well defined and equidistant; the first outcurved in cell, then oblique inward, dentate baseward on veins, preceded by a similar but more diffuse line; median line parallel to inner, well curved round the black cell spot; outer line also parallel, but dentate outward and lunulate inward, followed by a shade which forms an angulated black blotch on vein 4; submarginal line wavy, whitish, preceded and followed by coarse black confluent speckles; both this and the outer line are interrupted below vein 3; a black marginal line; fringe gray, becoming white below.

*Hindwing*.—Without basal lines; the dark shade beyond postmedian more developed; the submarginal broader, less waved; marginal line blacker.

Under side white, in the forewing black speckled; the three lines clear above the middle; cell spot black; a blackish marginal band; costa yellowish marked with black; hindwing with narrower blacker submarginal fascia fading out toward anal angle.

Head and thorax olive-gray; abdomen white peppered with gray and with indications of pairs of dark spots; forelegs black, with pale joints.

*Expanse of wings*.—68 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

The hind margin of forewing is distinctly elbowed at vein 6 and indented below.

*Type*.—Cat. No. 9353, U.S.N.M.

**BRONCHELIA MARCIDA**, new species.

*Forewing*.—Cream-color, thickly covered with olive-gray atoms; the lines very obscurely marked, except by the dark costal streaks; the first curved to near base of inner margin, preceded by a similar line; median bent out round the brownish cell spot, then oblique; outer line marked by brown points on veins; oblique outward to vein 6, vertical to 4, then incurved; submarginal line indicated by pale lunules between veins edged on each side by a somewhat deeper tint of gray; a fine darker marginal line; fringe concolorous.

*Hindwing*.—With an antemedian pale brown shade; the teeth of the outer line more strongly marked and followed by a broad pale brown shade; marginal line stronger.

Under side cream-white; costa of both wings with gray striæ.

Head, thorax, and abdomen like wings.

*Expanse of wings*.—60 mm.

*Locality*.—Castro, Parana, Brazil; 1 female.

*Type*.—Cat. No. 9354, U.S.N.M.

#### Genus BRYOPTERA Guenée.

#### BRYOPTERA ALBIPLAGA, new species.

*Forewing*.—White, more or less covered with olive and dull lilac suffusion, the pale parts with olive striæ; basal two-thirds of costa olive-drab; lines black, velvety, irregularly crinkled; first from one-fourth of costa to one-third of inner margin, angled in cell and preceded by an olive shade; outer line at two-thirds, parallel throughout to hind margin, followed by a broad band of olive and lilac scales, which fill up the lunules of the whitish submarginal line; marginal area with olive-green striæ, which are thickened along the submarginal line; some dark green spots between veins along margin; fringe whitish, mottled with olive; cell spot large, black, followed by a double median line running parallel to the outer line; the cell beyond inner line forms a prominent white blotch, and there is a smaller white blotch at base of inner margin, containing a dark spot at base beneath submedian vein.

*Hindwing*.—Without basal line, the rest as in forewing, but the lines clearer; the base of wing is white, and a large white blotch between cell spot and outer line, extending to costa.

Under side greenish ochreous; the outer two-fifths dark greenish fuscous, leaving the extreme margin and fringe ochreous; cell spots black.

Head, shoulders, patagia, and thorax pale pearl-gray; tips of patagia with black scales intermixed; basal segments of abdomen white with dark speckling; rest of abdomen grayish olive; palpi externally dark olive-brown; and a bar of the same color across middle of face.

*Expanse of wings*.—40 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, April, 1904.

Distinguished by its general moss-green appearance.

*Type*.—Cat. No. 9355, U.S.N.M.

#### BRYOPTERA NIGRILINEATA, new species.

*Forewing*.—Whitish, overlaid with moss-green and pale lilac scales; these last restricted to the marginal space beyond outer line and to the base of inner margin; first line thick, dark green, from before one-

third of costa, curved to one-third of inner margin, preceded by a similar but more obscure shade; outer line at two-thirds outcurved above middle, incurved below, black, followed by a green shade on a lilac ground; median line parallel to outer and nearer it than to first line, green; cell spot diffuse, green; submarginal line zigzag, followed by dark green and preceded by lilac, the space between veins 4 and 6 with some black scales in both areas; marginal spots black; fringe (worn) lilac.

*Hindwing*.—Basal three-fifths whitish; a green streak at base and broad green median shade meeting outer black line on inner margin; the rest as in forewing.

Under side dusty whitish, in forewing suffused with dull green and with a dark greenish marginal border, leaving apex and a spot below vein 4 whitish.

Head, thorax, and abdomen lilac-gray.

*Expanse of wings*.—27 mm.

*Locality*.—Ecuador; 1 male.

*Type*.—Cat. No. 9356, U.S.N.M.

#### Genus CYMATOPHORA Hübner.

#### CYMATOPHORA DIVERGENS, new species.

*Forewing*.—Pale gray, speckled with olive-fuscos; costa with numerous fine dark streaks; lines fine, dark; first curved at one-fifth; second, median, straight from before middle of costa to two-fifths of inner margin, slightly bent outward on vein 1; outer line fine, faintly lunulate between veins, from two-thirds of costa to three-fifths of inner margin, parallel to hind margin, followed by a darker shade only visible at inner margin where it forms two dark lunules; submarginal line obscure, defined by dark lunules beyond cell and above inner margin, and followed by a darker tint to the margin; cell spot dark, well beyond median line; marginal spots small; fringe gray.

*Hindwing*.—With straight antemedian line and double, nearly straight brown postmedian marginal area beyond it darker; submarginal line marked by dark spots only.

Under side uniformly pale, gray speckled; cell spots distinct; lines obscure, a cloudy dark fuscous submarginal shade, incomplete on hindwing.

Head, thorax, and abdomen like wings.

*Expanse of wings*.—44 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, November, 1904.

The two outer lines on both wings diverge from each other toward costa.

*Type*.—Cat. No. 9357, U.S.N.M.

**CYMATOPHORA FLEXILINIA, new species.**

*Forewing*.—Lilac-gray, whitish, thickly speckled with darker in one female; first line at one-fifth, angled in cell, second at two-fifths oblique and straight, both obscure; outer line at two-thirds distinctly bent on vein 4, then oblique, obscurely lunulate; all three lines are accompanied by a few fulvous scales, the last being followed by a darker shade, forming blackish blotches above and below vein 1; submarginal line denoted by a row of black spots between veins, these between 4 and 6 triangular and followed by larger wedge-shaped spots; cell spot and marginal spots black; fringe concolorous.

*Hindwing*.—With straight antemedian line slightly sinuous postmedian, the latter incurved toward costa and double toward inner margin; a row of submarginal dark spots and black marginal ones. In the female the marginal area in both wings is also tinged with fulvous.

Under side pale, thickly speckled with gray, in both sexes; the lines and a submarginal dark gray, stronger in the paler female.

Head, thorax, and abdomen concolorous in each case with wings.

*Expanse of wings*.—Male, 44 mm.; female, 40–44 mm.

*Locality*.—Jalapa, Mexico; 1 male, 2 females.

In the forewing the hind margin is slightly dentate at veins 4 and 6; the hindwing is crenulate throughout.

*Type*.—Cat. No. 9358, U.S.N.M.

**CYMATOPHORA VIRIDITINCTA, new species.**

*Forewing*.—Olive-ochreous, with olive striae; the lines starting from blackish costal blotches at one-fifth, two-fifths, three-fifths, respectively, waved parallel to hind margin and approximating on inner margin, the outer line double; submarginal line pale and waved at four-fifths, preceded by a series of dark lunular spots, and with dark spots beyond between veins 4 and 6; black marginal spots; fringe pale and dark olive.

*Hindwing*.—Without inner lines; a broad antemedian dark shade from inner margin followed by a dark cell spot, the rest as in forewing.

Under side pale greenish straw-color, without markings except a black submarginal shade on forewing, thinning out to anal angle, and widened to margin between 4 and 6; costa of forewing with olive spots and striae; black spots along margin; hindwing with cell spot and faint submarginal line at apex.

Head, thorax, and abdomen like wings.

*Expanse of wings*.—35 mm.

*Locality*.—Paraguay; 1 male.

*Type*.—Cat. No. 9359, U.S.N.M.

## Genus HYMENOMIMA Warren.

## HYMENOMIMA EXANGULATA, new species.

*Forewing*.—Pale gray with a slaty tinge, speckled with darker, in the marginal area suffused with slaty fuscous; lines thick, blackish, at one-fourth, one-half, and two-thirds of costa; first curved and above median double; median waved, and hardly outcurved round the large black cell spot; outer line velvety black, toothed outward on veins, running outward to vein 4, then bent sharply at right angles, and again more bluntly on submedian fold, there closely approaching middle line, followed by a thick dark strongly dentate shade; submarginal line slate-color, very slightly waved, edged on both sides by dark slaty fuscous shades; marginal dots quite small; fringe dark gray; from median line to the angle of outer line a patch of rose-colored scales runs along and below vein 4.

*Hindwing*.—With a thick antemedian dark shade, the rust-colored patch prominent.

Under side dirty gray, with a luteous tinge, paler beyond the large black cell spots before the broad black marginal border; fringe at apex and anal angle luteous-gray, between blackish. Head, thorax, and abdomen gray, speckled with darker; third and fourth dorsal segments with rust-colored scales.

*Expanse of wings*.—28 mm.

*Locality*.—Rockstone, Essequibo, British Guiana; 1 male, September, 1904.

*Type*.—Cat. No. 9360, U.S.N.M.

## HYMENOMIMA SUBNIGRATA, new species.

*Forewing*.—Whitish gray, with fine obscure darker striations and peppered with black; lines all starting from black costal spots; a black spot at base of cell, followed by a short line; first line at about one-fourth, double, the arms far apart on costa, the outer outcurved in cell, approximating near base of inner margin, outer line at two-thirds, lunulate-dentate, curved parallel to hind margin, black, followed by a dark gray, more strongly dentate shade; median line from a large costal spot, oblique outward and angled on veins 4 and 6, approaching outer line on inner margin; submarginal line whitish, regularly waved between two dark shades, forming a white spot on submedian fold; large black marginal spots; fringe dark and light gray; cell spot black, lunulate.

*Hindwing*.—Like forewing, but without the basal lines.

Under side smoky-fuscous, with broad smoky black marginal borders; the fringes white, with dark checkering beyond the veins; the apex of forewing narrowly whitish; cell spots black.

Head, thorax, and abdomen pale gray dusted with darker; shoulders black with their base white; vertex, collar, and basal segment of antennæ white; palpi black.

*Expanse of wings.*—48 mm.

*Locality.*—St. Laurent, Maroni River, French Guiana; 1 male, September, 1904.

*Type.*—Cat. No. 9361, U.S.N.M.

Genus IDIALCIS, new genus.

*Forewing.*—Narrow, elongate; costa slightly curved; hind margin obliquely curved, crenulate.

*Hindwing.*—Elongate; inner margin short; hind margin straight from anal angle to vein 4, thence rounded.

Antennæ of male bipectinate, the pectinations well separated, not so oblique as usual and ciliated; palpi porrect, short; tongue and frenulum present; no fovea in forewing.

*Neuration.*—Forewing, cell quite half as long as wing; discocellular vertical; first median nervule at four-fifths; second close to third; radials normal; 7, 8, 9 stalked; 10 and 11 stalked or coincident, 10 on the joint stalk anastomosing with 8, 9; hindwing, costal, and subcostal approximated for nearly the whole length of cell; 7 from close to upper angle, 3 from well before lower angle; no radial.

*Type.*—*Idialcis jacintha* Butler (*Phibalapteryx*).

The insects have the appearance of *Tephroclystia* and without examination the costal and subcostal of hindwings appear to anastomose, but there is no radial in hindwing.

IDIALCIS MEXICUBA, new species.

*Forewing.*—Brownish gray, speckled with darker, the wing presenting a rough appearance, as in *S. farinosa* Warren; the costa with dark striations; the lines obscure; first from one-fourth of costa curved inward to near base of inner margin, preceded by a similar line; outer line dark brown, from four-fifths of costa, oblique inward to below 7, then outcurved, and from 6 obliquely curved inward to middle of inner margin, emitting baseward black teeth along the veins and followed by a distinct brown shade; median line diffuse, bent out round the linear black cell spot and better marked above inner margin where it approaches outer line; submarginal line whitish, waved, followed by a brown-gray shade and preceded by a paler space; a dark marginal festooned line; fringe brown-gray.

*Hindwing.*—Paler toward costa; a blackish line at base; a gray antemedian line before the dark cell spot, the rest as in forewing.

Under side of forewing olive-cinereous, with the costa striated, and a dark marginal border and cell spot; hindwing dull whitish, speckled with olive-gray.

Face, palpi, and tips of shoulders black-brown; vertex, thorax, and abdomen like wings, the abdomen ringed with dark, and with a black belt at base; fore and middle legs dark fuscous in front.

*Expanse of wings*.—26 mm.

*Locality*.—Oaxaca, Mexico; 1 male.

*Type*.—Cat. No. 9362, U.S.N.M.

Genus IRIDOPSIS Warren.

IRIDOPSIS EUPEPLA, new species.

*Forewing*.—White with a slight tinge of ochreous-gray; lines starting from brown costal spots at one-third, one-half, and two-thirds, respectively; first angled in cell, then oblique to near base of inner margin, preceded by a pale brown shade; outer line incurved below costa, shortly projecting at vein 5, then sinuous inward to middle of inner margin, most clearly marked between veins 6 and 4, followed throughout by a brown shade; median line hardly marked, except sometimes on inner margin; cell spot concolorous, hardly visible; submarginal line inconspicuous except beyond cell, where it is preceded and followed by gray clouds and the oblique line from vein 7; submarginal spots black; fringe white.

*Hindwing*.—With straight antemedian gray line, followed by an elongated white cell mark with darker edges; outer line black, curved outward from costa to vein 7, then vertical to the fold, thence incurved to inner margin; the rest as in forewing.

Under side whitish, with a dull gray tinge in forewing; a dull dark gray marginal border, leaving apex of forewing pale; cell spots black; costa of forewing black spotted.

Head, thorax, and abdomen whitish; base of abdomen with a narrow black belt.

*Expanse of wings*.—Male 24 mm.; female 26 mm.

*Locality*.—Santiago, Cuba; 1 male, June, 1904; 1 female, October, 1902.

*Type*.—Cat. No. 9363, U.S.N.M.

IRIDOPSIS FUSILINEA, new species.

*Forewing*.—White, with black speckles; the lines black, the first double, the two arms well separated on costa, bent on subcostal vein, then oblique to near base of inner margin; outer line from two-thirds of costa, slightly inwardly curved at first then forming a short rounded projection on vein 5 and running to middle of inner margin, forming a blunt elbow on vein 4 and on submedian fold; it is followed by a dark shade marked with brown blotches on the veins; median shade illy marked, oblique outward from costa and angled in cell, touching outer line at vein 4 and close to it on submedian fold; cell spot ocelloid, white with black edge and a few brown scales at center; submarginal line

waved and distinctly edged with shades above middle, straighter but indistinct below; the lunules between 4 and 6 filled up with and followed by dark gray shading, edged above by an oblique streak from vein 7; submarginal spots large and conspicuous; the marginal line black; fringe pale gray.

*Hindwing*.—With black dash at base, blackish antemedian line, black postmedian line, forming a slight blunt angle on the fold and followed by a brown marked gray band; submarginal line flexuous between two flexuous dark shades; the black spots at margin connected with the black marginal festoon.

Under side dull white, both wings with dark cell spots and cloudy median line; forewing with costa streaked with black; a broad black apical cloud to vein 4, leaving apex itself white, continued as a diffuse blotch below vein 3; hindwing with a narrower submarginal dark cloud.

Head, thorax, and abdomen whitish speckled with dark, forming rings on the dorsal segments; a blackish band at base of abdomen.

*Expanse of wings*.—30 mm.

*Locality*.—Matanzas, Cuba; 1 female, November, 1902.

*Type*.—Cat. No. 9364, U.S.N.M.

#### IRIDOPSIS HUMILIS, new species.

*Forewing*.—Pale gray, rather glossy in certain lights, the basal and marginal areas faintly tinged with olive; costal edge finely streaked with black; lines fine, very obscure, starting from dark costal spots at one-third, one-half, and two-thirds; the first running to near inner margin and marked with a black spot on veins; outer marked with a black spot below vein 6, roundly projecting on vein 5, then sinuous inward to before middle of inner margin, black from 5 to 4, and followed by a faintly darker shade; the pale, slightly glossy submarginal line lunulate, edged with darker, the lunules beyond cell filled up with blackish, followed by an oblique curved dark streak from vein 7 which projects into the pale gray fringe; submarginal spots black; marginal line finely black; cell spot ocelloid, of the ground-color.

*Hindwing*.—Like forewing; the cell mark with dark edges; the outer line nearly straight, the shade beyond it crenulate; the submarginal shades thicker and darker.

Under side smoky gray clouded with darker; the cell spots and a broad marginal border smoky blackish; apex of forewings and fringes of both wings pale gray; costa of forewing with black spots; a dark blotch below cell spot of forewing.

Head, thorax, and abdomen like wings; base of shoulders blackish, their apex olive; palpi externally and a broad central bar across face dark brown.

*Expanse of wings*.—27 mm.

*Locality*.—Santiago, Cuba; 1 male, November; 1 female, June, 1902.

*Type*.—Cat. No. 9365, U.S.N.M.

**IRIDOPSIS INVENUSTA, new species.**

*Forewing*.—Pale bone-color dusted with dull gray speckles; the lines dull gray; first double, the arms far apart on costa, approximating at one-half of inner margin; cell mark ocelloid, filled in with gray and edged with darker, followed by an obscure diffuse gray median shade; outer line from three-fourths of costa, incurved at first, bluntly rounded outward on vein 5, then sinuous inward to three-fifths of inner margin, followed by a diffuse gray shade; two dark gray submarginal gray shades containing between them the paler submarginal lines; blackish marginal spots touching a fine marginal line; fringe pale gray.

*Hindwing*.—Like forewing but without basal markings; cell spot dark-edged, but not filled in with darker, touching internally a waved gray antemedian line.

Under side dirty bone-color without markings; forewing with blackish cell spot and diffuse apical cloud.

Head, thorax, and abdomen like wings; face and palpi brownish gray.

*Expanse of wings*.—35 mm.

*Locality*.—Rio Janeiro, Brazil; 1 male.

An inconspicuous insect.

*Type*.—Cat. No. 9366, U.S.N.M.

**IRIDOPSIS MEMOR, new species.**

*Forewing*.—Cinereous, dusted and tinged with fuscous; the lines starting from dark costal spots at one-third, one-half, and to two-thirds; the first curved inward to near base of inner margin, preceded by a dark cloud which meets it below and is divergent above; outer line lunulate-dentate, marked with black spots on veins 7 and 6, incurved below middle to middle of inner margin, followed by a dark shade; median line angled well beyond the black cell spot, touching outer line at vein 4; submarginal line evenly lunulate, pale, between two dark shades, the inner the deepest, black lunules along margin; fringe pale gray.

*Hindwing*.—Like forewing without basal line; the median shade thick and diffuse.

Under side whitish ochreous smudged with smoky gray; a broad smoky black marginal border, leaving apex of forewing and whole margin of hindwing narrowly pale; cell spots black; costa of forewing ochreous, with black striae and spots.

Head, thorax, and abdomen like wings; base of abdomen with a black belt; face and palpi brown-black.

*Expanse of wings.*—37 mm.

*Locality.*—Omai, British Guiana; 1 male. Exceedingly like the European *Alcis gemmaria*.

*Type.*—Cat. No. 9367, U.S.N.M.

**IRIDOPSIS RUFISPARSA, new species.**

*Forewing.*—White, freckled with gray, more strongly in male than in female; lines blackish, rising from dark gray costal spots; the first before one-third inwardly curved to one-fifth of inner margin, the outer from two-thirds of costa, obliquely curved outward and forming a blunt projection on vein 5, then twice sinuous inward, slightly angled on vein 2 and again just above inner margin, which it reaches at middle; the first line is preceded and the outer followed by a parallel gray shade containing bright red scales, some of them also appearing on the inner line itself; a gray median line bent outward beyond cell, then incurved; cell mark large, of raised white scales, surrounded with olive scales and with bright red scales in middle; submarginal line lunulate between gray shading of varying intensity, the inner deeper beyond the cell and on hind margin to vein 7, where the dark is abruptly cut off, leaving the apex pale; a fine marginal line, preceded by a distinct series of black spots; fringe white, mottled with gray beyond veins.

*Hindwing.*—With a black basal dash, a waved antemedian line ending in a dark spot on middle of inner margin; outer line angled on the fold, the shade beyond it reddish brown; the cell mark trilobed, edged with dark.

Under side with a slight gray flush; cell spots large and dark, with the median shade obscurely marked; a broad blackish marginal border, narrowing and becoming fainter toward anal angle; leaving apex white and a pale patch between veins 3 and 4 on forewing; fainter and submarginal on hindwing.

Head, thorax, and abdomen white, mixed with gray in the male, which also has the face and palpi gray; abdomen with a strong black belt at base; the dorsal segments with pairs of red spots and in the male tinged with gray.

*Expanse of wings.*—Male, 38 mm.; female, 44 mm.

*Locality.*—Santiago, Cuba; 1 male, November; 1 female, June, 1902.

The red scales are easily overlooked, and are most plentiful in the male. I am inclined to believe this is the insect identified with *larvaria* Guenée by Herrich-Schaeffer and Gundlach.

*Type.*—Cat. No. 9368, U.S.N.M.

**IRIDOPSIS TRANSVISATA, new species.**

*Forewing.*—Semihyaline whitish, with a faint green tint, finely peppered with black scales; costa ochreous, streaked and spotted with

black; lines at one-third, one-half, and two-thirds; the first curved and narrow but preceded by a broad blackish band; median line angled beyond cell, then oblique and below middle, swelling into a broad band all but touching outer line; outer line marked by black points on the veins, sinuous, bent at vein 5 and outcurved again on inner margin; marginal area mainly filled with a blackish cloud, except at apex and margin between 3 and 4, through which the pale waved submarginal line is visible; marginal spots black; fringe pale gray, checkered with darker; cell spot black in a diffuse cloud.

*Hindwing*.—Similar, without basal lines; a broad median band; cell spot ocelloid, with pale center; outer line marked by black vein spots, forming a square projection between vein 6 and the fold, strongly concave below.

Under side opalescent ochreous, with a faint pink tinge; both wings with broad black marginal border, the fringes and apex of forewing pale; cell spot of forewing larger; of hindwing small, blackish.

Thorax and abdomen olive-ochreous, like wings; head and palpi dark brown; dorsum tinged with darker; basal segment with black scales.

*Expanse of wings*.—39 mm.

*Locality*.—Omai, British Guiana; 1 male.

*Type*.—Cat. No. 9369, U.S.N.M.

#### Genus PHEROTESIA Schaus.

##### PHEROTESIA INDISTINCTA, new species.

*Forewing*.—Grayish olive mixed with brown, the whole densely dusted with black atoms; costal edge with dense blackish striæ; the lines darker but indistinct, and all in parts geminate; first from one-half of costa to one-third of inner margin, outcurved above and below median; it is preceded by an ill-defined dark streak running to inner margin near base; outer line from two-thirds of costa to two-thirds of inner margin, lunulate-dentate, somewhat angularly projecting on vein 4, the outer arm in a brownish olive shade; cell spot black, traversed by a fine median line in the main parallel to outer line; submarginal line pale, somewhat interrupted, preceded and followed by darker olive shades; marginal dark spots between veins; fringe checkered dark and lighter olive. The brown tints are disposed chiefly along the course of the two folds.

*Hindwing*.—Dirty whitish ochreous, dusted with gray-green scales, and darker along hind margin; traces of greenish lines above anal angle; fringe gray, beyond a fine wavy marginal line.

Under side, like upper side of hindwing, gray speckled; the hind margin darker, especially toward apex; costa of forewing yellowish, with black striæ; cell spot of hindwing large and black.

Head and thorax like forewing; abdomen like hindwing, but darker along dorsum; forelegs and antennæ mottled black and ochreous.

*Expanse of wings*.—37 mm.

*Locality*.—Orizaba, Mexico; 1 male.

Though I have placed this species in *Pherotesia* Schaus, by reason of the presence of a distinct radial in the hindwing, it differs considerably in appearance from other species, and will probably require a genus for itself. In both wings the discocellular is triangulate, the radial in each case rising from the lower, outward angulation.

*Type*.—Cat. No. 9370, U.S.N.M.

Genus *PHYSOCLEORA* Warren.

*PHYSOCLEORA ALBIBRUNNEA*, new species.

*Forewing*.—White, the basal and marginal areas deep brown; the first and third lines black from a little before one-third and two-thirds of the costa; the first curved to the outer edge of the large pale fovea; the outer outcurved above to vein 3, then incurved to submedian fold, and thence vertical to three-fifths of inner margin; an interrupted blackish median line outcurved round the black cell spot; submarginal line slightly paler, being preceded by a deeper brown shade; marginal spots black; fringe brown.

*Hindwing*.—With basal half white; a broad dark antemedian shade; outer line followed by a narrow pale line (which is less evident in the forewing); anal area of marginal space whitish.

Under side like upper, but the dark markings more diffuse and fuscous.

Face and palpi dark brown; vertex, shoulders, and patagia white; thorax and metathorax brown; abdomen white, with a narrow dark belt at base, and the third and fourth segments blackish.

*Expanse of wings*.—15 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

*Type*.—Cat. No. 9371, U.S.N.M.

*PHYSOCLEORA CRETARIA*, new species.

*Forewing*.—Chalk-white; costa dark gray at base, with four dark spots at origin of lines, with black spots between them; first and second large and diffuse, formed of olive and black scales, oblique outward; third small and black; fourth largest, oblique inward, of olive scales; the first three at one-fourth, one-half, and two-thirds; the lines marked by olive scales; first angled in cell; second on vein 6; the first curved inward, the second sinuous, the third outcurved from 6 to 2, and forming a sinus inward on submedian fold, marked by black spots on veins 6 and 1, and a black blotch above and below vein 4, followed by an incomplete olive shade; the submarginal shade preceding submarginal line rises from the fourth costal blotch, is marked by an

orange patch above vein 6, and broken olive scaling below, on each side of vein 4 forming olive and brown patches and below vein marked only by its outer edge; the outer shade is marked only by olive blotches beyond cell and on vein 2; marginal dots small; fringe white, with irregular olive mottling.

*Hindwing*.—With dark antemedian and postmedian lines, the latter followed by an olive shade; the two submarginal shades ill-defined, clearest toward apex; cell spot black.

Under side whitish, freckled and tinged with olive on forewing; a dark, smoky, olive, marginal shade narrowing to anal angle, leaving apex and a patch below vein 4 paler; costa spotted with dark; hindwing freckled along costa only; cell spots present on both wings.

Head, thorax, and abdomen white; the last with a pair of large black blotches on second segment; palpi white mixed with olive; legs olive, paler at the joints.

*Expanse of wings*.—26 mm.

*Locality*.—Castro, Parana, Brazil; 1 female.

Hind margin of hindwing deeply indented beyond cell.

*Type*.—Cat. No. 9372, U.S.N.M.

#### PHYSOCLEORA FULGURATA, new species.

*Forewing*.—Whitish, thickly sprinkled, and beyond outer line suffused with brownish fuscous; lines dark brown, at one-fourth and two-thirds, thickened on costa; first curved, projecting above and below median vein; median curved round and nearly touching the rather large linear black cell spot, then incurved to middle of inner margin; outer line blacker on veins, curved parallel to median, followed by a fulvous shade; submarginal line whitish, strongly zigzag through the brownish marginal area, which is a little paler before the large black marginal lunules; fringe gray-brown with dark dashes near base.

*Hindwing*.—Similar, but without inner line; cell spot large and round.

Under side with the basal area as far as median line dark like the marginal in the forewing; in the hindwing with the base of antemedian line paler; in both wings the outer line followed by a pale line.

Vertex, thorax, and abdomen varied, light and dark like wings; face and palpi dark brown.

*Expanse of wings*.—16 mm.

*Localities*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904; 60 miles up Maroni River; 1 female, August, 1904.

*Type*.—Cat. No. 9373, U.S.N.M.

#### PHYSOCLEORA FUSCICOSTA, new species.

*Forewing*.—White, the basal space, costa, and marginal area with dark greenish fuscous shadings; costa thickly striated with dark, and

with dark blotches at the origins of the lines; the lines very fine, first at one-fourth, angled in cell, then vertical to median, then inwardly oblique, the inclosed space except the fovea, greenish fuscous; outer line at two-thirds, outcurved from vein 6 to 2 and marked by large dark spots on veins, followed by a green shade, mixed with lilac, submarginal line indistinct, inclosed between two greenish fuscous bands, both interrupted between 3 and 4, and 6 and 7; large blackish green marginal spots connected by a fine dark festoon; fringe moss-green, dashed with pale beyond veins; a fine dark cell spot; median line shown only by a dark costal spot and some green streaks on inner margin.

*Hindwing*.—With wavy antemedian line and black cell spot, the rest as in forewing; but the submarginal shades still more broken up by the white ground-color.

Under side of forewing suffused with greenish fuscous, with the dark cell spot, outer line and submarginal shades shown; hindwings whitish, with the lines punctiform.

Head, shoulders dark olive-fuscous, thorax and abdomen whitish mottled with dark; the two basal segments white.

*Expanse of wings*.—26 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

The hind margin of hindwing is deeply insinuate beyond cell.

*Type*.—Cat. No. 9374, U.S.N.M.

#### PHYSOCLEORA NUBILATA, new species.

*Forewing*.—Grayish white, clouded with dark gray; the lines fine, blackish, rising at even distances on the costa; at one-third, one-half, and two-thirds, the first and second bent in cell, the third marked by dark spots on veins and approaching median line on inner margin, followed by a broad, dark gray band, the outer edge of which fills up the lunules of a pale submarginal line, the margin itself being again dark gray; marginal spot black; fringe dark gray; cell spot small, black; fovea large, round, scaleless.

*Hindwing*.—Without inner line.

Under side similar; the cell spots larger and blacker, the dark gray shades still darker. Vertex, thorax, and abdomen gray speckled with darker; face, palpi, and forelegs dark fuscous.

*Expanse of wings*.—15 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, March, 1904.

Very much like *Hymenomima minuta* Warren, but with lines, not bands.

*Type*.—Cat. No. 9375, U.S.N.M.

#### PHYSOCLEORA RECTIVECTA, new species.

*Forewing*.—Grayish white, or white thickly freckled with pale olive scales; the lines olive-gray, starting from dark costal spots at one-

third, one-half, and two-thirds; the first and second outcurved above middle, the third outcurved from vein 7 to 2, marked by dark vein spots; submarginal line gray, zigzag, preceded and followed by olive-fuscos shading mixed on veins 3, 4, and 6 in the inner band with fulvous scales, this band stopping short at vein 3, the outer interrupted between 3 and 4; extreme margin gray; marginal spots black, conspicuous; cell spot slight; fringe pale and dark gray.

*Hindwing*.—Without basal line.

Under side dull white, flushed with olive in forewing where the costa shows fine oblique dark dots and spots; both wings with broad black margins with straight inner edge, leaving the fringes whitish; cell spots slight.

Head and thorax whitish, speckled with olive; abdomen missing; legs fuscous.

*Expanse of wings*.—24 mm.

*Locality*.—Nova Fiburgo, Brazil; 1 female.

Distinguished by the straight edged dark borders of the under side.

*Type*.—Cat. No. 9376, U.S.N.M.

#### PHYSOCLEORA SCUTIGERA, new species.

*Forewing*.—White, with a few olive-gray speckles; the basal area and costal space more thickly dusted; lines olive-fuscos, starting from dark costal spots at one-third, one-half, and two-thirds; the first bent on subcostal and again on submedian fold, straight between and oblique below, with a gray shade in front of it; median line bent outward beyond the slight gray cell spot, then oblique inward; outer line marked by dark vein dots, outbent between 6 and 3, strongly inbent in submedian interspace, followed by a dark olive-fuscos blotch on vein 4, and a slight olive shade throughout; two dark olive-fuscos shades define the waved submarginal line; marginal spots large and dark; fringe white varied with gray.

*Hindwing*.—Without basal line; the rest as in forewing, but the outer line regularly lunulate-dentate followed by a well marked olive shade.

Under side white; forewing clouded with olive-gray to beyond middle, leaving a white ill-defined space before the broad blackish hind margin; costa with fine pale and dark streaks; hindwing wholly white except a small gray cloud at apex; fringes white.

Head, thorax, and abdomen white; face with a dark central bar; shoulders with a dark gray spot in front; third and fourth segments of abdomen with a black saddle, pale in center; anal segment blackish above before the tufts; legs whitish.

*Expanse of wings*.—26 mm.

*Locality*.—Chaco, Bolivia; 1 male.

*Type*.—Cat. No. 9377, U.S.N.M.

**PHYSOCLEORA SUFFUSCA, new species.**

*Forewing*.—Whitish gray, thickly and uniformly powdered with olive-gray; the lines indistinct, except at costa, the exterior marked by black vein spots and black from vein 5 to 3, followed by a double blotch of fulvous and fuscous scales, the fulvous lying on the veins; the submarginal line waved, between two darker gray bands; marginal spots black, connected by a fine black festooned line; fringe gray; cell spot obscure.

*Hindwing*.—Like forewing, without inner line, the cell spot black; the shade beyond outer line complete, fulvous tinged.

Under side of forewing olive-fuscous, paler before the dark fuscous margin; fringe whitish; cell spot black; hindwing white, with fuscous cell spot and marginal spots.

Head, thorax, and abdomen like wings, pale gray speckled with darker; face brown.

*Expanse of wings*.—25 mm.

*Locality*.— —; 1 female.

Like *P. rectiseeta* but grayer, and with the hindwing beneath wholly white.

*Type*.—Cat. No. 9378, U.S.N.M.

**PHYSOCLEORA VENIRUFATA, new species.**

*Forewing*.—White, sparsely blackish speckled; the lines blackish, fine; the costal area thickly dusted with gray; first line strongly curved from one-third of costa to one-fourth of inner margin, marked blacker on the veins, preceded by a broader shade, which is marked in the male by a red spot on median vein; median line indistinct, angled on vein 6 beyond the black cell spot; outer line from three-fourths of costa sinuous, mottled blacker on veins, followed by a gray shade, which forms a double blotch on each side of vein 4, veins 6, 4, and 3 being marked with rufous; submarginal line waved, whitish, defined by dark shades; cell spots black; fringe whitish, checkered with gray.

*Hindwing*.—Like forewing, with only a dark bar at base.

Under side white, slight grayish toward costa of forewing, which is striated and spotted with dark; a broad blackish border, narrowing to anal angle and continued shortly at apex of hindwing.

Head, thorax, and abdomen white, speckled with gray; abdomen with gray dorsal rings and a black belt at base; face with a dark bar in middle; legs white; forelegs mottled with fuscous.

*Expanse of wings*.—Male, 25 mm.; female, 26 mm.

*Localities*.—Castro, Parana, Brazil, 2 females; Rio Janeiro, 1 male.

In the male the rufous markings are stronger, the shade beyond outer line in both wings being tinged with that color and the blotch below vein 4 nearly wholly rufous; in females, one of which is much

darker than the other, the rufous is restricted to the veins, the darker female has a dark band on hindwing beneath reaching anal angle.

*Type*.—Cat. No. 9379, U.S.N.M.

Genus STENALCIDIA Warren.

STENALCIDIA NITENS, new species.

*Forewing*.—Chalk-white, faintly dark-speckled; costa with small black striæ; the lines black; first from one-fourth of costa, angled on subcostal, then obliquely curved inward to near base of inner margin, inclosing the fovea; a black costal spot at middle, from which traces can be seen of an outbent median shade; outer line from three-fourths of costa to two-thirds of inner margin, slightly outbent beyond cell, incurved below vein 4, thick and dentate outward on veins, emitting a spur to hind margin from vein 4; shade before submarginal line represented by two contiguous blackish marks at costa, two more beyond cell, and some gray ones below; the shade beyond by two dark marks beyond cell only; marginal spots black, lunular, those below costa produced inward; fringe white.

*Hindwing*.—With black basal spot, curved median line below cell, black cell spot and exterior line; a faint submarginal shade.

Under side dull white, in the forewing tinged with gray; the lines indicated, especially the outer line.

Head, thorax, and abdomen white; shoulders and a thick ring on basal segment of abdomen black; the other segments with pairs of dark dots; palpi black.

*Expanse of wings*.—34 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

*Type*.—Cat. No. 9380, U.S.N.M.

Genus STENOTRACHELYS Guenée.

STENOTRACHELYS INSULARIS, new species.

*Forewing*.—Male ochreous, densely sprinkled with blackish specks and striæ, and partially tinged with brown; the lines black and thick; first from before one-third of costa outcurved above and oblique inward to one-fifth of inner margin; second from beyond middle of costa, outcurved above, then inward, closely approaching first line on vein 2 to middle of inner margin; outer line from four-fifths of costa to two-thirds of inner margin, sinuous, followed by a brown shade which is edged by an irregularly dentate black line, which is itself edged by the submarginal line which, when visible, is whitish; a black marginal line interrupted by the pale veins; fringe brownish gray, with pale base; cell spot black.

*Hindwing*.—With median and outer lines approximated, the median touching a whitish cell spot; marginal area filled in with dark, showing in places a whitish submarginal line.

Under side wholly brown, thickly speckled with fuscous, the marginal areas darker.

Head, thorax, and abdomen like wings; vertex snow-white.

*Expanse of wings*.—36 mm.

*Locality*.—Santiago, Cuba; August, 1902.

*Type*.—Cat. No. 9381, U.S.N.M.

Subfamily FIDONIINÆ.

Genus EUILETA Warren.

EUILETA? SUBCÆSIA, new species.

*Forewing*.—Purplish slate-color, with four vertical wavy dentate dark brown lines, from costa at one-fifth, two-fifths, three-fifths, and four-fifths, the second and third insinuate on both folds, the second followed by a dark cell spot; submarginal line thickened, and edged with paler; marginal line dark, interrupted at veins; fringe concolorous.

*Hindwing*.—With the outer three lines, the cell spot between first and second.

Under side slate-color, both wings with two thick lines; cell spot and broad marginal border dark brown.

Head, thorax, and abdomen like wings; face dark brown.

*Expanse of wings*.—16 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male; July, 1904.

In breadth and shortness of wing, and also in markings this species is remarkably like the type species *E. hirsuta* Warren from Tijuco, Brazil; but in the hindwing the costal and subcostal veins approximate only for one-third of cell, but certainly do not anastomose.

*Type*.—Cat. No. 9382, U.S.N.M.

Genus HYPOMETALLA Warren.

HYPOMETALLA PURPUREA, new species.

*Forewing*.—Dark slaty-purple; the lines deep brown with edging of dull yellow scales; costal edge yellow with purple dots; extreme base dark; first line at one-fourth, thick, curved inward and joining basal patch on inner margin; a slight curved middle line preceding the dark cell mark; outer line from four-fifths of costa to three-fourths of inner margin, blotched and waved; traces of a dark submarginal line; marginal line thick, interrupted at the vein ends; fringe purple with yellow line at base.

*Hindwing*.—With antemedian, postmedian, and submarginal line, all very obscure.

Under side duller, with the lines dark.

Head, thorax, and abdomen all dark purplish; the face with some dull reddish orange scales intermixed.

*Expanse of wings.*—17 mm.

*Locality.*—St. Jean, Maroni River, French Guiana; 2 females; April, 1904.

Differs from the type species in not having any metallic scales on the under face of the wings; the sinus beyond cell in hind margin of hindwings is very slight.

*Type.*—Cat. No. 9383, U.S.N.M.

**HYPOMETALLA? SCINTILLANS, new species.**

*Forewing.*—Deep velvety brown, with a purplish tinge in places, and dusted except in outer half of wing, with fine bluish scales; a thick brown line near base, angled outward in cell, then inwardly oblique; the cell itself paler, tinged with fulvous, the discocellular marked with a fine brown vertical line, followed by a patch of silvery white, beyond which there are traces of a brown median line; a thick brown postmedian line joined to a large brown cloud reaching toward hind margin, across which runs a submarginal row of fulvous spots; marginal line black-brown with fulvous spots at the vein ends; fringe brown.

*Hindwing.*—Dark purplish, sprinkled with blue scales, with a curved submarginal dark band; a small white cell spot.

Under side with a broad yellow-ochreous streak along costa to one-half and along inner margin nearly to anal angle; a white blotch beyond cell, followed by a blackish space, which toward costa becomes brown and fulvous; patches of blue scales in places, continuous along hind margin; hindwing purplish, with two dark curved bands and bluish gray scales along hind margin.

Head, thorax, and abdomen purplish black.

*Expanse of wings.*—16 mm.

*Locality.*—St. Jean, Maroni River, French Guiana; July, 1904, 1 male.

The species may be left for the present in *Hypometalla*, with which it agrees in the main, having veins 7, 8, 9, 10, 11 all stalked together and the hindwing deeply excavated beyond cell; it differs in that veins 3, 4 are stalked in both wings and that the antennæ of the male are beset with pedicellate fascicles of cilia, appearing to be pectinated. The inner margin of forewing and costa of hindwing are sinuate; the anal angle of forewing being produced as a lobe and the hindwing shouldered at base and more broadly before apex.

*Type.*—Cat. No. 9384, U.S.N.M.

**Genus LEPIDOSPORA, new genus.**

*Forewing.*—Broad; costa convex at base and before apex; hind margin as long as inner margin, which is convex.

*Hindwing.*—Small, rounded, the whole surface except extreme base and inner margin covered with a thick bed of mealy scales.

Antennæ of male subserrate ciliated; palpi quite short; tongue and frenulum present; abdomen with long fluffy anal segment.

*Neuration*.—Forewing, cell hardly half as long as wing, broad; discocellular oblique, the cell rounded at lower end; first median nervule at four-fifths; second and third from the rounded end; lower radial from above middle of discocellular, upper from upper angle; 7, 8, 9 stalked; 10, 11 coincident, anastomosing with 12; hindwing, cell very short, discocellular strongly concave, the lower half oblique; costal and subcostal closely approximated for nearly the whole length of cell; 6, 7 short stalked; medians as in forewing; no radial.

*Type*.—*Lepidospora lanuginosa*, new species.

**LEPIDOSPORA LANUGINOSA, new species.**

*Forewing*.—Yellow-ochreous; the markings brown; costa dotted with brown, and with brown spots at one-fourth, one-half, and three-fourths, indicating origin of lines, which are all interrupted subcostally and appear as three oblique very sinuous brown streaks, the first close to base, the second just beyond and partly double, the third at two-thirds, all developed into brown patches on the margin; submarginal lines broken up into three gray-brown patches, one from costa, a longer one in middle, and a third on inner margin; marginal area filled with brown striæ; patches of dark brown scales along hind margin; fringe brown with pale yellow base; sprinkled over the whole surface and in the fringe are pale slightly shining scales.

*Hindwing*.—Inner margin spotted with brown, indicating the lines; basal area ochreous edged with brown; the fluffy scales deeper yellow; fringe glossy.

Under side ochreous; forewing brown in cell and with some mealy olive scales below the lower end; a broad brown marginal fascia and the fringe brown; costa spotted with brown; hindwing with brown central line and broad submarginal fascia; fringe pale; face in middle, fillet, antennæ, base of shoulders, thorax and dorsum black-brown; basal segment and anal tufts of abdomen, and the other parts pale ochreous.

*Expanse of wings*.—17 mm.

*Locality*.—Tijuca, Brazil; 1 male.

*Type*.—Cat. No. 9385, U.S.N.M.

**Genus MIMOPHYLE Warren.**

**MIMOPHYLE PARALLELA, new species.**

*Forewing*.—Dull cinereous; the lines purplish, all more or less parallel to each other and hind margin; first at one-fourth; median thick, especially below middle, its other edge dentate; outer line at two-thirds, fine, crenulate, with paler edge externally; marginal area

darker, traversed by a pale waved submarginal line; an interrupted dark marginal line; fringe concolorous.

*Hindwing*.—Without basal line.

Under side paler, with marginal area darker; the lines dark, cell spots in both wings large and black.

Head, thorax, and abdomen like wings; face dark brown.

*Expanse of wings*.—15 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, April, 1904.

This female shows a distinct fovea in forewing like male.

*Type*.—Cat. No. 9386, U.S.N.M.

#### Genus NARRAGODES Warren.

##### NARRAGODES LÆVIS, new species.

*Forewing*.—Purplish fuscous; the costal edge ochreous dotted with blackish; lines darker, thickened at costa; first curved near base; median diffuse from below middle of costa, strongly outcurved round cell spot, to middle of inner margin; outer line from two-thirds of costa, obliquely curved outward, angled on vein 6, incurved below 3; a fine dark marginal line; fringe fuscous.

*Hindwing*.—With costal area whitish; two dark curved somewhat waved lines, postmedian and submarginal; fringe of hindwing obsolete.

Under side much paler; the lines olive-brown, dark on costa of forewing which is broadly yellow.

Head, thorax, and abdomen all purplish fuscous.

*Expanse of wings*.—22 mm.

*Locality*.—Peru; 1 male.

Distinguished from *N. fuscata* Warren from Brazil, with which it agrees in size and shape, by the smooth scaling and distinct lines.

*Type*.—Cat. No. 9387, U.S.N.M.

#### Genus PORONA Schaus.

##### PORONA? BALTEATA, new species.

*Forewing*.—Pale yellow, with a broad fuscous band before middle and a broader fuscous marginal border; fringe fuscous; costa at base dotted with fuscous and with a spot beyond middle.

*Hindwing*.—The same, the costa unspotted.

Under side like upper.

Thorax and abdomen yellowish, the latter with three fuscous belts; head and collar fuscous; forelegs fuscous in front.

*Expanse of wings*.—17 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; March, 1904.

*Type*.—Cat. No. 9388, U.S.N.M.

## Subfamily SEMIOTHISINÆ.

## Genus NEAZATA, new genus.

*Forewing*.—Costa well curved throughout; apex produced; hind margin excised from apex to vein 4, thence sinuous to anal angle.

*Hindwing*.—With hind margin rounded, crenulate, deeply sinuate beyond cell. Antennæ of female filiform; palpi damaged; tongue and frenulum present.

*Neuration*.—Forewing, cell half as long as wing; discocellular vertical; first median nervule a little beyond one-half; second close before third; radials normal; 7, 8, 9, 10 stalked, 11 free; hindwing, costal, and subcostal shortly approximated near base; 7 before angle; medians as in forewing; no radial.

*Type*.—*Neazata multistrigaria*, new species.

## NEAZATA MULTISTRIGARIA, new species.

*Forewing*.—Cream-color, traversed by numerous long and slender brown striæ and tinged in places with yellow-ochreous; the lines are present, but more or less obscured; first from one-third of costa to one-third of inner margin, angled outward in cell, and there marked by a brown spot; outer line at two-thirds, outcurved in middle and dentate outward on the veins, thick and brown; closely preceded by a thick brown shade, which is obscurely forked above middle; an irregularly dentate dark brown submarginal shade, the margin beyond it slaty gray; marginal line dark brown; fringe ochreous, mottled with brown at the ends of the veins; all the lines seem to be accompanied by yellow-ochreous shading.

*Hindwing*.—With two thick dark brown lines close together just beyond middle, followed by a pale band and a diffuse brown submarginal shade.

Under side pale ochreous, thickly speckled with brown and gray; forewing with outer line brown on the veins, an interrupted brown submarginal shade, and the apical area gray; hindwing with a broad brown shade before outer line.

Head, thorax, and abdomen ochreous, with brown speckling; abdomen with a dark ring.

*Expanse of wings*.—27 mm.

*Locality*.—Petropolis, Brazil; 1 female.

*Type*.—Cat. No. 9389, U.S.N.M.

## Genus SCIAGRAPHIA Hulst.

## SCIAGRAPHIA STABILATA, new species.

*Forewing*.—Dull whitish, dusted with gray atoms, especially along inner margin; in the marginal area on each side of the paler submarginal line these atoms are tinged with gray and form two bands, the

inner with still darker blotches on costa, inner margin, and between veins 3 and 4; the three lines start from three black costal triangular marks and are all angled below subcostal vein; the first line curved inwardly on inner margin, the other two outwardly; the outer line darkest and marked with blackish on the veins; dark gray marginal spots; fringe gray, double, the base and middle line both showing paler, and mottled with deeper gray beyond veins.

*Hindwing*.—Similar, without first line: cell spot in both wings dark, partially obscured.

Under side like upper, but decidedly yellow tinged along costa and in marginal areas of both wings; the veins yellowish; the lines less marked; but the cell spots distinct.

Head, thorax, and abdomen whitish, gray speckled.

*Expanse of wings*.—30 mm.

*Locality*.—Oaxaca, Mexico; 1 female.

*Type*.—Cat. No. 9390, U.S.N.M.

#### Genus SEMIOTHISA Hübner.

#### SEMIOTHISA ABRUPTA, new species.

*Forewing*.—Hyaline yellowish white, suffused with rufous, the ground-color showing only in the foveal space, in patches along cell and before the outer line from costa to vein 2; the whole surface speckled with dark; along costa beyond outer line there is a tint of violet-gray; lines very indistinct, but starting from conspicuous costal dark brown streaks; first streak outwardly oblique to middle of cell, second broad before middle, third at two-thirds, oblique inward, continued as a line to three-fourths of inner margin and marked by broad black teeth on veins, connected by rufous lunules; a dentate-edged black-brown submarginal shade from vein 4 to anal angle; a white bent streak from costa into apex; thick black marginal dashes on a brown marginal line; the veins rufous at ends; fringe ochreous and rufous.

*Hindwing*.—Wholly suffused with rufous; a thick antemedian dentate-lunulate postmedian line, its teeth in middle black; a chestnut-brown shade along margin from apex to middle, below middle pale ochreous beyond a dark-edged rufous submarginal shade; fringe above middle black; below pale ochreous.

Under side with thick waved median shade and broad outer fascia rich chestnut-brown; forewing with costa yellow, and apical area white, the inner margin and whole of hindwing suffused with rufous; hyaline patches of forewing as above; a blackish band from apex of hindwing to tooth at middle.

Head, thorax, and abdomen chestnut-brown and ochreous.

*Expanse of wings*.—28 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

Forewing with bluntly falcate apex; hind margin inflected below apex, but not excised; anal angle square; hindwing with costa and hind margin from apex to tooth perfectly straight, meeting at an obtuse angle; hind margin below tooth crenulate; forewing with large contorted fovea; antennæ of male pubescent.

*Type*.—Cat. No. 9391, U.S.N.M.

**SEMIOTHISA ATOMARIA, new species.**

*Forewing*.—Dull pale ochreous, densely powdered with olive-gray specks and striæ; costa yellowish with dark brown dots, lines very pale brown, all marked by a few blackish scales on the veins; first at one-fourth, bent in cell; second oblique just before middle, outer angled on vein 6, then oblique parallel to median; a gray submarginal shade marked only on costa and at anal angle; dark marginal dashes between veins; fringe pale gray with ochreous base; cell spot linear gray.

*Hindwing*.—Paler and less thickly speckled; without first line.

Under side the same, but paler and yellower.

Head, thorax, and abdomen concolorous.

*Expanse of wings*.—28 mm.

*Locality*.—Peru; 1 male.

Antennæ with tuberculate fascicles of cilia; forewing not excised, hindwing bluntly angled at middle; no fovea in forewing.

Very close to *S. subvalida* Warren from Paraguay.

*Type*.—Cat. No. 9392, U.S.N.M.

**SEMIOTHISA DECORATA, new species.**

*Forewing*.—Brownish ochreous, thickly speckled with fuscous, costal edge yellowish with black dots and streaks; first and second lines ill-defined, formed by black and yellow scales; first close to base starting as a black costal streak and angled in cell; second, median, at two-fifths, vertical and waved, outer line velvety brown-black, strongly toothed outward on veins, vertical at two-thirds, followed closely by a leaden-gray band; submarginal line pale ochreous, somewhat lustrous, preceded by distinct brown shading forming a partial band; a black crescent before excision and black lunules below middle; fringe black beyond excision, black mottled with yellow-ochreous and with a yellow basal line below middle.

*Hindwing*.—With antemedian and dentate postmedian line of black and fulvous scales, with a large black cell spot between them; the submarginal pale line and brown band preceding it more complete than in forewing; fringe wholly yellow-ochreous, darker beyond veins, and at vein 4 marked with fuscous.

Under side yellow straw-color, black speckled; median line blackish; a black and chestnut-brown postmedian fascia; the inner half black, not reaching costa, the outer half brown, not reaching inner margin; thorax, abdomen, and legs ochreous, mottled with brown and fuscous; face, palpi, and vertex brown, becoming paler below.

*Expanse of wings*.—30 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female; April, 1904.

Probably near *rhyngiata* Guenée.

*Type*.—Cat. No. 9393, U.S.N.M.

**SEMIOTHISA FERVENS, new species.**

*Forewing*.—Pale ochreous, almost entirely covered with violet-gray striæ and suffusion; costal edge yellow, with dark dots; lines deep ferruginous, mixed with yellow scales; first at one-fourth, oblique outward, bent in cell and curved below median; the areas inclosed within it on each side of the median vein whitish, the fovea preceding large, triangular, its edges marked by dark scales; median line from middle of costa to two-fifths of inner margin, almost straight, touching cell spot; outer line thick and sinuous at two-thirds, edged with paler; forming a larger sinus beyond cell and on submedian fold; submarginal line pale, preceded by a ferruginous waved shade; marginal area with black-gray striæ; marginal lunules black; fringe gray.

*Hindwing*.—Without fovea or basal line.

Under side pale straw-color with ferruginous striations; middle line and cell spot marked with ferruginous; outer line slightly marked, followed by a narrow bright ferruginous shade, diffuse externally and edged by dark lunules with pale spots before the violet-gray marginal area. Head and antennæ dark brown; thorax and abdomen like wings.

*Expanse of wings*.—25 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, September, 1904.

Hind margin of forewing sinuous, not excised; of hindwing hardly toothed at middle; straight below middle, crenulate above; antennæ of male thickened, with tuberculate fascicles of cilia.

Very much like *S. heterogenata* Guenée, but the course of the outer line is altogether different.

*Type*.—Cat. No. 9394, U.S.N.M.

**SEMIOTHISA LAPIDATA, new species.**

*Forewing*.—Pale stone-color, covered with faint gray striæ, those along the marginal area darker; costa with short dark marks; oblique dark streaks from costa at one-fourth, one-half, and three-fourths, from which the usual three lines run to inner margin, the first and second curved and simple, third marked by black dots on veins, followed by

a curved gray band to anal angle; apical area rather paler; a gray marginal line and gray fringe.

*Hindwing*.—Similar, without first line; submarginal band and fringe paler.

Under side pale ochreous with sparse olive dusting; middle line faint; the cell spots linear, gray; a dark fuscous band beyond outer line, the marginal area beyond fuscous-speckled; the veins fuscous.

Face and palpi dull brown; vertex, thorax, and abdomen like wings.

*Expanse of wings*.—24 mm.

*Locality*.—Orizaba, Mexico; 1 female.

Hind margin of forewing faintly excised below apex, then rounded; hindwing with blunt angle at middle. The whole insect has a faint greenish tinge.

*Type*.—Cat. No. 9395, U.S.N.M.

#### SEMIOTHISA LIQUATA, new species.

*Forewing*.—Wood-brown; costal edge ochreous, striped with blackish, oblique dark brown streaks from costa at one-fifth, two-fifths, and two-thirds, the lines from them obscure, but marked with black on submedian vein, the outer line on all the veins; beyond outer line a dark brown band, intensified into a blotch at costa and bounded by a very indistinct submarginal line running to anal angle; marginal area brown except for a lilac-gray apical patch containing two black costal spots, a black marginal line; fringe brown with a pale ochreous dash at apex.

*Hindwing*.—With the lines plainer; the antemedian line preceded by black scaling beyond a pale base; the interval between postmedian and submarginal lines darker and the submarginal line paler.

Under side fulvous-yellow, densely striated with dark brown; median shades and cell spots dark brown; outer half of forewing dark brown with some white spots before apex; in hindwing the marginal area below middle fulvous-yellow.

Head, thorax, and abdomen wood-brown; abdomen below, yellowish.

*Expanse of wings*.—22 mm.

*Locality*.—Peru; 1 male.

Forewing not excised; hindwing crenulate,肘ed only at middle. No fovea in forewing.

*Type*.—Cat. No. 9396, U.S.N.M.

#### SEMIOTHISA MULTISTRIATA, new species.

*Forewing*.—Whitish, thickly covered with ashy gray striæ; the lines and shadings all of the same color; these are placed almost exactly as in *S. carpo* Druce, the outer line being marked by two black conspicuous spots on veins 3 and 4; marginal area darker, being suffused with gray, forming a broad band near the outer line; beyond the very obscure submarginal line, the margin is flecked with whitish,

and at the apex is white with a few gray speckles; fringe gray, beyond a fine dark marginal line.

*Hindwing*.—Without first line; the hind margin moderately toothed at middle.

Under side whiter, the lines and speckling brown; fascia beyond outer line brown, broader at costa than inner margin, extending to margin between veins 4 and 6; the veins brown; costa of forewing yellowish with dark striations; in the hindwing the band is narrower and not extended to margin.

Head, thorax, and abdomen ashy gray.

*Expanse of wings*.—26 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

Hind margin of forewing sinuous, without excisions; fovea of forewing slight.

*Type*.—Cat. No. 9397, U.S.N.M.

**SEMIOTHISA PLURIMACULATA, new species.**

*Forewing*.—Pale ochreous, finely speckled with olive and black; the costa marked with black spots at one-fifth, two-fifths, and three-fifths; the three lines pale olive, the first and second bent below subcostal, then oblique, slightly waved inward; the outer bent outward between veins 6 and 2, slightly black marked on the veins, with two large confluent black spots on veins 3 and 4, and followed throughout by a pale space beyond which the marginal area is lilac-gray tinged with rufous, toward the hind margin beyond an indistinct submarginal line; on the inner edge of this space on costa is a large quadrate brown blotch reaching vein 6, beyond which the apex is white, and a small black blotch between veins 3 and 4; marginal line brown, thicker and darker before the excision; fringe pale gray; cell spot olive.

*Hindwing*.—Without basal line and dark blotches; the submarginal line denoted by a dark line elbowed in middle, the marginal area ochreous with brown striations.

Under side washed with yellow, the lines brown; the outer line followed in forewing by a black shade broadening to anal angle, in hindwing narrowing to the angle and broad above; apex of forewing white, with brown speckling.

Head, thorax, and abdomen ochreous speckled with brown.

*Expanse of wings*.—26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, April, 1904.

*Type*.—Cat. No. 9398, U.S.N.M.

**SEMIOTHISA PUNCTISTRIATA, new species.**

*Forewing*.—Pale grayish olive, with a few black atoms; the lines very fine and marked by distinct black dots on veins; first curved close

to base; median just before middle, passing over the olive cell spot and marked by a black dot only on submedian vein; outer line angled at vein 6, the dots on vein 3, 4 larger, followed by a dark shade, forming a cloud at costa and between veins 3 and 4; fringe like wings.

*Hindwing*.—Without inner line.

Under side yellowish ochreous, dusted with fuscous; median lines and outer bands marked, the latter more as lines than bands; cell spots distinct, linear.

Head, thorax, and abdomen like wings.

*Expanse of wings*.—24 mm.

*Locality*.—Orizaba, Mexico; 1 female.

Distinguished by the uniform tint and dotted lines.

Hind margin of forewing slightly excised; hindwing bluntly angled.

*Type*.—Cat. No. 9399, U.S.N.M.

**SEMIOTHISA SUBFULVA, new species.**

*Forewing*.—Brownish fawn-color, with a yellowish tinge as far as outer line, beyond it slightly grayer, speckled throughout with brown; costa with short dark brown striae, and three triangular dark brown spots at one-fifth, two-fifths, and two-thirds; first line outcurved, bent in cell; middle line, slightly bent in cell, then parallel to inner line, marked by a distinct dark brown spot on vein 1; outer line rust-color, straight to below vein 2, then slightly curved outward, followed by a thick gray-brown shade which runs to anal angle and is there thickened, the line itself curving inward away from it and marked by a brown spot on vein 1; marginal line rust-color, thickened before the excision; fringe pale rust-color with the tips darker; cell spot linear, dark brown.

*Hindwing*.—With nearly straight gray-brown antemedian line and rust-colored outer line; this is twice curved, forming a tooth baseward on the fold and incurved from vein 2, the gray shade following inconspicuous except from vein 3 to anal angle; cell spot round.

Under side bright fulvous, the lines, cell spots, and speckling rich brown.

Thorax and abdomen like wings; head deep brown.

*Expanse of wings*.—35 mm.

*Locality*.—Chiriqui, Panama; 1 male. This is the species identified in the *Biologia* as *seperataria* Moeschler. The fovea is large, hyaline, with a raised pustule hindward, which is marked beneath by black scales.

*Type*.—Cat. No. 9400, U.S.N.M.

**SEMIOTHISA SARDA, new species.**

*Forewing*.—Smooth, olive-drab, with a slight rufous tinge toward hind margin, much speckled with fuscous; the lines themselves are distinct except at costa, where they rise from brown costal streaks;

inner line olive and curved above and below median vein; median a little before middle, touching the dark linear cell spot; outer line at two-thirds is distinctly dentate-lunulate, and is followed by a darker band, which forms two dark blotches below costa and another between veins 3 and 4, and a third on inner margin; a dark costal spot before apex; a dark olive-fuscescent marginal line in upper half of wing, and the fringe fuscous.

*Hindwing*.—With thick antemedian line before the round dark cell spot; denticulate postmedian line, followed by a brown band with dark outside edge; fringe pale olive.

Under side pale dull olive-ochreous, with dark speckling; the lines all fuscous, the submarginal shade linear on forewing, broad on hind wing.

Head, thorax, and abdomen concolorous with wings.

*Expanse of wings*.—37 mm.

*Locality*.—Rio Dagua, Colombia; 1 male.

Hind margin of forewing oblique and straight; of hindwing bluntly elbowed, not toothed, at middle.

*Type*.—Cat. No. 9401, U.S.N.M.

#### Genus *TEPHRINA* Guenée.

#### *TEPHRINA ALBISECTA*, new species.

*Forewing*.—Cream-white, covered with a thick dusting of gray scales, the inner edge of first line and outer edge of outer alone remaining pale; first line dark, curved at one-fourth; median shade blackish, waved, curved round the dark cell spot, but only plain toward inner margin; outer line lunulate-dentate from five-sixths of costa to two-thirds of inner margin, angled on vein 7; a pale submarginal line, the dark shading preceding it, ending in a point at vein 7; dark marginal markings; fringe (worn) gray.

*Hind wing*.—The same, without first line; the dark median shade and pale submarginal line both plainer.

Under side dusted with yellow scales, the markings the same.

Head and antennæ dark brown; thorax and abdomen like wings.

*Expanse of wings*.—32 mm.

*Locality*.—Jalapa, Mexico; 1 female.

*Type*.—Cat. No. 9402, U.S.N.M.

#### *TEPHRINA? CONFERTISTRIGA*, new species.

*Forewing*.—Pale sulphur-colored, with scattered gray striations, dark gray and denser in marginal area; first line curved at one-fourth, and outer straight from four-fifths of costa to three-fourths of inner margin, both very indistinct and only marked by darker yellow, but the first preceded and the other followed by a pale line of unspeckled

ground-color; on equally indistinct median shade, dark, touching the black cell spot; lines of black scales along margin between veins; fringe pale.

*Hindwing*.—The same, without first line.

Under side the same, but yellower; the veins yellowish.

Head and shoulders ferruginous; thorax and abdomen like wings; antennæ pale; black spotted on each segment.

*Expanse of wings*.—22 mm.

*Locality*.—Castro, Parana, Brazil; 1 female.

Of doubtful position in the absence of the male.

*Type*.—Cat. No. 9403, U.S.N.M.

#### Genus TEPHRINOPSIS Warren.

##### TEPHRINOPSIS INDETERMINATA, new species.

*Forewing*.—Whitish, covered with gray and fuscous striæ, confluent in places and giving a blotchy appearance to the wing; a distinct black cell spot; no lines are visible across the wings, but blackish spots on costa at one-fourth, one-half, and two-thirds denote their origin; some dark scales along hind margin; fringe gray.

*Hindwing*.—Paler, with a small cell spot.

Under side paler, sandy-ochreous, without markings except the cell spots.

Head, thorax, and abdomen like wings.

*Expanse of wings*.—22 mm.

*Locality*.—Oaxaca, Mexico; 1 male.

*Type*.—Cat. No. 9404, U.S.N.M.

#### Genus XENOECISTA Warren.

##### XENOECISTA TRIMACULATA, new species.

Differs from *X. pallidata* Warren in the possession of three black spots forming a blotch, two in the course of the outer line on veins 3 and 4, contiguous and one beyond in the space between these veins; the outer line, on the contrary, is marked by black vein spots in neither wing.

*Locality*.—Cayenne, French Guiana; 1 male, February, 1904.

*Type*.—Cat. No. 9405, U.S.N.M.

#### Subfamily ENNOMINÆ.

#### Genus ACROTOMODES Warren.

##### ACROTOMODES UNICOLOR, new species.

*Forewing*.—Uniform reddish brown with two darker lines; the first at fully one-third, bluntly angled in cell; the second from costa at two-thirds, right-angled on veins 7 and oblique inwards to two-thirds of

inner margin, followed by a slightly darker shade from a dark costal blotch before apex; some scattered gray scales in the marginal area, especially toward apex.

*Hindwing*.—With the lines parallel at one-third and two-thirds; the outer followed by a pale line and much darker marginal areas.

Under side black speckled; the forewing reddish brown, with costal and apical areas grayish; hindwing with inner margin pale, and outer margin gray; both wings with dark brown outer lines and fringes.

Head, thorax, and abdomen gray; face somewhat browner.

*Expanse of wings*.—26 mm.

*Locality*.—São Paulo, southeastern Brazil; 1 female.

*Type*.—Cat. No. 9406, U.S.N.M.

#### Genus ASESTRA Warren.

##### ASESTRA LINEATA, new species.

*Forewing*.—Orange, overlaid with confluent fuscous striæ, which almost obliterate the ground-color; costal edge white, dotted with fuscous; lines black, continuous, not punctulate, as is usual in this genus; first from one-third of costa to near middle of inner margin, slightly bent on median vein; outer line from four-fifths of costa, where it is outwardly edged with white; to three-fourths of inner margin, bluntly bent at vein 6 and again below vein 4, vertical from vein 2; before it between veins 3 and 4 a small blotch of the orange ground-color, cell spot linear black; a submarginal dark cloud most distinct on inner margin, but marked also beyond cell and on costa; fringe fuscous with whitish tips; veins all finely dark.

*Hindwing*.—Dull whitish, freckled with gray, dark gray along hind margin and especially at anal angle; a waved dark outer line and linear cell spot; fringe dark gray; a fine dark marginal line accompanied by whitish scales.

Under side pale dull ochreous overspread with olive-gray; all the markings dark; fringe olive-gray in basal half, whitish in outer half and checkered with dark beyond veins.

Head, thorax, and abdomen olive-fuscous; vertex, shoulders, and patagia fulvous.

Under side of abdomen and legs mottled ochreous and fuscous.

*Expanse of wings*.—35 mm.

*Locality*.—Carabaya, southeastern Peru; 1 male.

*Type*.—Cat. No. 9407, U.S.N.M.

#### Genus ATOPODES, new genus.

*Forewing*.—Costa sinuous, slightly indented beyond middle; apex produced, acute; hind margin well curved; anal angle rounded.

*Hindwing*.—With strongly rounded hind margin.

Antennæ in female bipectinate; forehead with cone of scales; palpi large, porrect, roughly and loosely haired, the third segment decumbent; tongue and frenulum present.

*Neuration*.—Forewing, cell more than half the length of the wing; discocellular oblique below; first median nervule at three-fourths; second close to third; radials normal; 7, 8, 9 stalked from shortly before end of cell; 10, 11 stalked, anastomosing strongly with 12, 10 anastomosing again strongly with 8, 9; hindwing, costal anastomosing with subcostal for more than half of cell; 7 from upper end of cell with 6; 3 from well before lower end; no radial.

*Type*.—*Atopodes singularis*, new species.

In appearance resembling the African genus *Nopia*, but in structure of head and palpi allied to *Rhinodia* Guenée from Australia. The abnormal anastomosis of the costal and subcostal of hindwings separates it.

ATOPODES SINGULARIS, new species.

*Forewing*.—Pale fawn-color, with slightly darker transverse striæ and a few black atoms; costa yellowish ochreous, spotted with brown; lines brown; first curved from beyond one-third of costa to one-third of inner margin; outer from shortly before apex, oblique to vein 7, there sharply angled and oblique inward to two-thirds of inner margin, slightly waved from vein to vein; from the angle a black streak to apex; cell spot dark; fringe brown with pale tips.

*Hindwing*.—With base paler and hind margin darker; a dark cell spot, and brown outer line, obsolete above cell.

Under side paler, with thick olive-brown striations; inner margin whitish, veins brown; outer lines brown; cell spots black.

Head, thorax, and abdomen whitish ochreous; shoulders yellow; palpi thickly speckled with fuscous; legs and under side of abdomen ochreous speckled with brown.

*Expanse of wings*.—30 mm.

*Locality*.—Castro, Parana, Brazil; 1 female.

*Type*.—Cat. No. 9408, U.S.N.M.

Genus AVENTIOPSIS, new genus.

*Forewing*.—Costa convex, strongly depressed at apex; hind margin shortly but angularly excised below apex; strongly in middle, straight and oblique below.

*Hindwing*.—Hind margin evenly curved, both angles distinct.

Antennæ of male quite simple, lamellate; palpi short, porrect; tongue and frenulum present.

*Neuration*.—Forewing, cell not half as long as wing; discocellular vertical; first median nervule at one-half, second well before third; radials normal; 7, 8, 9, 10 stalked; 11 anastomosing with 12; hindwing,

costal shortly approximating to subcostal; 7 considerably before end of cell.

*Type*.—*Aventiopsis ochrea*, new species.

In markings and shape of forewing the genus recalls *Aventia*.

**AVENTIOPSIS OCHREA, new species.**

*Forewing*.—Pale ochreous, washed with rufous toward hind margin and with a few coarse black scales; lines slightly brownish, double; first from one-third of inner margin oblique to end of cell, there recurved to costa, but this upper portion is hardly visible; outer line from two-thirds of inner margin straight toward apex, before which it is angled bluntly on vein 7 and retracted to costa; fringe concolorous; a small black cell spot.

*Hindwing*.—With both lines produced across it and traces of a submarginal; cell spot black.

Under side more rufous; inner margin of forewing whitish; the lines faint.

Head, thorax, and abdomen all pale ochreous; patagia whitish; shoulders and head slightly grayer.

*Expanse of wings*.—20 mm.

*Locality*.—Castro, Parana, Brazil; 1 male.

*Type*.—Cat. No. 9409, U.S.N.M.

**Genus BASSANIA Walker.**

**BASSANIA AMETHYSTATA variety EXTREMATA, new.**

*Forewing*.—Pale olive-rufous; with fine black speckling; costal edge dotted with pale; a minute black cell dot; the outer line runs exactly as in the type form, straight from two-thirds of inner margin to costa shortly before apex, but it is marked only by white dashes on the veins and by the contrast of color between the rufous before the line and a pale green shade beyond it, the outer edge of which is toothed on the veins and on inner margin reaches anal angle; this shade is followed above vein 7 by a blackish triangular blotch reaching apex; marginal area and fringe rufous; near the base there appears a pale green curved inner shade.

*Hindwing*.—Pale olive-straw color, yellower toward inner margin, toward hind margin reddish tinged and dotted with black, the reddish tinge and speckling intensified at anal angle and forming a dark blotch beyond an undefined submarginal line; fringe dull lilac above middle, chestnut-brown below it.

Under side as in type, with a short black zigzag line on costa before apex, instead of a blotch.

Head and thorax colored like forewing, abdomen like hindwing.

*Locality*.—One male from Carabaya, southeast Peru. Of the same size as *amethystata* type.

*Type*.—Cat. No. 9410, U.S.N.M.

Genus CABERODES Guenée.

CABERODES? ASPILATARIA, new species.

*Forewing*.—Pale straw-color; the lines pale brown; first at one-third, forming a strong angle outward on median vein; outer line from five-sixths of costa oblique outward to vein 7, very obscure, there angled and nearly straight to two-thirds of inner margin, followed on costa by a triangular brownish patch; fringe concolorous; cell spot obscure.

*Hindwing*.—With a curved postmedian line.

Under side more speckled and tinged with olive brownish, especially along hind margin and in cell of forewing; outer line gray-brown, curved, not angled, from four-fifths of costa; this line in hindwing is angled on the cell fold.

Head, thorax, and abdomen bone-color; the segment of abdomen tinged with pale brown; legs brown externally.

*Expanse of wings*.—40 mm.

*Locality*.—Oaxaca, Mexico; one female.

Not a true *Caberodes*, as the female antennæ are well pectinated.

*Type*.—Cat. No. 9411, U.S.N.M.

CABERODES NEXILINEA, new species.

*Forewing*.—Pale ochreous, dusted with olive-gray, most thickly in the basal area; inner line very ill-defined; from one-half of costa to one-third of inner margin, bluntly angled in cell before the black cell spot, just before which on the costa a short brownish streak indicates a median shade; outer line pale brownish, oblique from apex to two-thirds of inner margin; from the costa before apex a gray line curves outward and crossing the oblique line runs close alongside it to inner margin, where they join; some patches of olive-gray scales indicate a submarginal line; fringe pale, gray from apex to middle.

*Hindwing*.—With the brown oblique line continued straight from vein 6 to two-thirds of inner margin, beyond the black cell spot; a strongly curved gray submarginal line joining the outer line at costa and inner margin.

Under side more thickly and darkly speckled, the lines browner.

Head, thorax, and abdomen straw-color.

*Expanse of wings*.—40 mm.

*Locality*.—Castro, Parana, Brazil; 1 female.

*Type*.—Cat. No. 9412, U.S.N.M.

## Genus CANNAGARA Walker.

## CANNAGARA HIMERODES, new species.

*Forewing*.—Brown with a slight reddish tinge; inner line from quite one-third of costa to one-third of inner margin; bent in cell, slightly darker marked on the three veins and followed by a darker brown shade; outer line fine, lunulate-dentate, more or less parallel to hind margin, from costa a little before apex to two-thirds of inner margin, projecting hindward from 6 to 7; a blackish cell spot, followed by a cloudy darker brown median shade; joining outer line at inner margin; on costa beyond outer line is a small patch of gray and black scales; fringe concolorous.

*Hindwing*.—Altogether paler, especially toward base, with slight black speckling, fringe and hind margin more rufous.

Under side of both wings like upper side of hindwing; fringe darker; traces on forewing of outer line and pale blotch on costa.

Head, thorax, and abdomen like forewing.

*Expanse of wings*.—48 mm.

*Locality*.—Tres Marias, Mexico, 9,000 feet.

*Type*.—Cat. No. 9413, U.S.N.M.

## Genus CROCOPTERYX Guenée.

## CROCOPTERYX HILARIS, new species.

*Forewing*.—Pale yellow, flushed with olive at base and along costa, with short sparse brown striae; costal edge striated with olive-brown; the lines represented by olive-brown blotches; first from two-fifth of costa to one-third of inner margin, consisting of a large costal blotch pointing outward and two inwardly oblique ones below, one in cell, the other on submedian interval, and a small spot on the margin; outer line formed of a large outwardly directed blotch at three-fourths and four irregular spots in an inwardly oblique line below veins 4, 3, 2, and 1; the first row is preceded and the second followed by an interrupted line of pearly scales, best marked on costa; submarginal line represented by a blotch on costa and another on vein 3; fringe olive, tipped with brown, yellow below apex.

*Hindwing*.—Yellow, with a few olive specks; a central shade ill-defined, containing a brown blotch on costa.

Under side yellow, with the striae and all the markings which are large and confluent deep chestnut-brown; a broad irregular brown fascia on forewing from three-fourths of costa to anal angle; the fringe and margin brown below vein 5.

Head and antennae brown; vertex, thorax, and abdomen yellow; a brown spot on preanal segment.

*Expanse of wings*.—26 mm.

*Locality*.—Chiriqui, Panama; 1 male.

This species is allied to *C. aurora* Warren from southeast Peru.

*Type*.—Cat. No. 9414, U.S.N.M.

**CROCOPTERYX? VENUSTA, new species.**

*Forewing*.—Cream-color flushed with olive, with a few purplish atoms; the costa with short purple striæ; inner line marked by a purplish costal streak at two-fifths, angled across cell, then oblique inward, the lower half all but obsolete; outer line purple, oblique outward, and narrow from three-fourths of costa, angled sharply on vein 7, then inwardly oblique to three-fifths of inner margin, more or less obsolete itself, but accompanied exteriorly by a thick olive-green band from apex; the first line is edged inwardly, the second outwardly, by lustrous scales, which are only plain at costa; both start from purplish-black costal spots; a third spot before apex indicates the submarginal line, which is represented below middle by a shade of pink and black scales forming spots to anal angle; fringe olive-green, the tips purple.

*Hindwing*.—With a double, purple central line filled in with lustrous scales and edged externally with greenish; marginal half suffused with rosy and olive, with a submarginal spot before apex on costa; fringe purplish.

Under side bright yellow, with coarse, red-brown striæ; the lines red-brown; marginal areas filled up with red-brown, in the forewing tinged with black.

Head, palpi, and antennæ purple; thorax and abdomen cream-color; four last segments of dorsum tinged with purple and olive.

*Expanse of wings*.—24 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 female, October, 1904.

Almost certainly a *Crocapteryx*.

*Type*.—Cat. No. 9415, U.S.N.M.

**Genus CYCLOMIA Guenée.**

**CYCLOMIA LILACINA, new species.**

*Forewing*.—Dull lilac-gray, black speckled; the lines leaden-gray, disposed and shaped exactly as in *tumidilinea*, except that in the present species the first and second lines are nearer together on inner margin, whereas in *C. tumidilinea* the second and third approximate to each other there; on the outside of the middle line is an oval olive-yellow cell mark; and beyond outer line an olive brownish shade with dentate outer edge and widened at costa; a fine, black marginal line; fringe lilac-gray.

*Hindwing*.—Paler, with two lines, the outer double, followed by a blackish marginal border.

Under side olive-yellow, freckled with darker; the apex of forewing fulvous; the three costal blotches and the marginal area dull lilac.

Thorax and abdomen lilac-gray; head and shoulders rather paler.

*Expanse of wings*.—18 mm.

*Locality*.—Santa Lucia, British West Indies; 1 male.

*Type*.—Cat. No. 9416, U.S.N.M.

**CYCLOMIA STRIGIFERA, new species.**

*Forewing*.—Pale brownish ochreous, covered with transverse olive striations; these are thickened and confluent at four-fifths of wing, forming a curved outer line, and there appear traces of an outcurved inner line at one-third; cell spot small, blackish; a row of marginal black dots; fringe concolorous.

*Hindwing*.—With cell spot black and large; the outer line nearer hind margin.

Under side olive-yellow, with fuscous striæ; costa and inner margin of forewing paler, without striæ; cell spot black; traces of a double outer line; hindwing with cell spot and an apical brown blotch.

Head, thorax, and abdomen like wings.

*Expanse of wings*.—21 mm.

*Locality*.—Jalapa, Mexico; 1 male.

*Type*.—Cat. No. 9417, U.S.N.M.

**CYCLOMIA TUMIDILINEA, new species.**

*Forewing*.—Olive-ochreous, thickly speckled with dark; the lines leaden-gray; at one-fourth, one-half, and three-fourths, curved parallel to one another, all swollen at costa and on inner margin and filled with gray; cell spot black in the middle line; slight black marginal dots.

*Hindwing*.—With only the two outer lines.

Female tinged with red-brown, deeper along hind and inner margin, ochreous toward costa; hindwing yellower, with only the hind margin brownish.

Under side yellow, with the lines, cell spot and striæ purplish.

Head and thorax concolorous with the wings; abdomen wanting.

*Expanse of wings*.—Male, 18 mm.; female, 22 mm.

*Locality*.—Coatepec, Mexico; 1 male, 1 female.

The female is nearest *C. rubida* Warren, from Rio Janeiro.

*Type*.—Cat. No. 9418, U.S.N.M.

**Genus DECTOCHILUS Butler.**

**DECTOCHILUS DECENS, new species.**

*Forewing*.—Grayish testaceous, speckled with dark atoms; lines brown; first curved from one-third of costa to one-third of inner margin; outer from five-sixths of costa to two-thirds of inner margin,

almost straight; a dark cell spot, followed by a very faint median shade; fringe concolorous; darker beyond veins.

*Hindwing*.—With costal area and basal half pale ochreous; only the postmedian line shown and not reaching costa; traces of a submarginal dark shade.

In the female the coloration is browner, the lines paler, and the outer line edged with a pale line.

Under side similar.

Head, thorax, and abdomen concolorous with wings; face and palpi a little darker.

*Expanse of wings*.—Male, 40 mm.; female, 42 mm.

*Locality*.—Las Vegas, Perote, Mexico; 1 male, 1 female.

*Type*.—Cat. No. 9419, U.S.N.M.

#### DECTOCHILUS TINCTA, new species.

*Forewing*.—Pale brick-red; darker before outer line and hind margin, speckled and striated with olive; the lines olive, thick, first evenly curved at one-third, outer quite straight from five-sixths of costa to two-thirds of inner margin; cell spot brown, large, followed by a diffuse reddish median shade; traces of a dark submarginal shade at costa and inner margin only; fringe concolorous.

*Hindwing*.—Whitish ochreous, tinged with rufous only toward hind and inner margins and there speckled with olive; outer line fine, curved parallel to hind margin; cell spot small.

Under side of forewings pale ochreous with only the hind margin rufous, of hindwings rufous-ochreous throughout; outer line fuscous and strongly marked throughout on hindwings, only on costa of forewing; fringe darker.

Head and thorax concolorous with forewing; abdomen with hindwing.

*Expanse of wings*.—40 mm.

*Locality*.—Las Vegas, Perote, Mexico; 1 male.

This species has the hind margin of both wings more deeply crenulate than the preceding.

*Type*.—Cat. No. 9420, U.S.N.M.

#### Genus EUSENEA Walker.

#### EUSENEA SEMIBRUNNEA, new species.

*Forewing*.—Male, reddish brown from base to outer line, which is lilac-gray and quite straight from beyond two-thirds of costa to two-thirds of inner margin; inner line obscurely marked, forming a slight rounded projection above median vein, then running vertical, hardly waved, to inner margin at one-third, the basal area somewhat grayer than the central, both with deep brown striations; costal area above

subcostal vein less brown but with plainer striations; marginal third gray-brown, thickly black speckled; a darker brown shade beyond outer line; the veins paler; fringe brown, with finely paler base and tips; submarginal spots dark, tipped with gray; cell spot dark, hardly marked; costal edge yellowish ochreous.

*Hindwing*.—Dull fuscous, with a nearly straight pale gray line at three-fifths; marginal area below vein 4 brown speckled with fuscous, the brown running up narrowly along inner margin; fringe brown; submarginal spots black and large.

Under side gray-brown, dappled with pale gray; outer line paler; marginal area chestnut-brown, in forewing only above middle, leaving apex pale gray; a pale gray marginal blotch from vein to anal angle of forewing; submarginal spots pale gray.

Head and thorax dark brown; abdomen paler brown; antennæ pale ochreous, subdentate, finely pubescent; abdomen beneath brown; the pectus gray.

*Expanse of wings*.—40 mm.

*Locality*.—Bolivia; 1 male.

Female with all the tints paler and the striations fewer; the outer line slightly curved toward costa; cell spot of forewing small, formed of white scales; of hindwing dark, obscure; both cell spots showing dark and plain on under side which is without the pale gray dappling.

*Locality*.—Geldersland, Surinam River, Dutch Guiana.

Notwithstanding the differences here mentioned, I think these specimens belong to one and the same species. The apex of forewing of female is as usual more produced.

*Type*.—Cat. No. 9421, U.S.N.M.

#### Genus ENTOMOPEPLA Warren.

##### ENTOMOPEPLA BIPARS, new species.

*Forewing*.—Mouse-color, with a single pale faintly curved line from three-fifths of inner margin to three-fourths of costa, the area before it darker than the marginal; a small black cell spot; fringe dark above middle angle, rufous tipped with white in the curve below; costal edge yellowish dotted with blackish.

*Hindwing*.—With the line straight from three-fifths of costal to three-fourths of inner margin; fringe with the tips white throughout.

Under side pale grayish slate-color as far as on outer line, nearly straight on forewing and slightly curved on hindwing; the marginal border mouse-color, with apex of forewing pale gray and traces of a pale dentate submarginal line.

Head, thorax, and abdomen mouse-color; shoulders white; abdomen below and pectus pale slate-color; legs mottled ochreous and black.

*Expanse of wings*.—48 mm.

*Locality*.—St. Jean, Maroni River, French Guiana, April, 1904.

Resembles *E. albicollaris* Warren in the white shoulders, but larger, and distinguished by the pale curved line; that species also occurs in French Guiana.

*Type*.—Cat. No. 9422, U.S.N.M.

Genus GONORTHUS Butler.

GONORTHUS BILINEATA, new species.

*Forewing*.—Pure white, the fringe included; the only markings are the traces of a gray submarginal line; these only visible at costa and on inner margin.

*Hindwing*.—With some submarginal striæ which on inner margin resolve themselves into two double lines.

Under side pure white.

Thorax and abdomen white; face and palpi white below, red-brown above, vertex and base of antennæ bronzy purple; pectinations ferruginous; collar narrowly orange; legs white; fore and middle femora and tibiæ deep yellow; the knees black.

*Expanse of wings*.—38 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

*Type*.—Cat. No. 9423, U.S.N.M.

Genus IRA Walker.

IRA ALBIRENATA, new species.

Like *Ira decurtaria* Herrich-Schaeffer in size, shape, and markings, differing only in the following points: the costal blotch before apex, instead of being elongated and filled up with blackish, is short, rounded, somewhat kidney-shaped, filled with white, with its center on costa of the ground-color, the blotch is nearer the apex, and consequently the outer lunulate-dentate line starting from below its outer edge is nearer the hind margin, and the central area is therefore broader; and, secondly, this central area is of the same tint as the rest of the wings, not filled up with darker as in *decurtaria*; both wings have an olive-fuscous tinge, becoming dull lilac-gray toward the hind margin.

*Expanse of wings*.—54 mm.

*Locality*.—Carabaya, southeastern Peru; 1 male.

*Type*.—Cat. No. 9424, U.S.N.M.

Genus MICROGONIA Herrich-Schaeffer.

MICROGONIA ALBICOMMA, new species.

*Forewing*.—Flesh-colored ochreous, minutely black speckled; first line hardly traceable, vertical, outcurved above and below median; outer line broad, chestnut-brown, inwardly diffuse, outwardly well

defined, marked by minute dark pale tipped dots on veins, and in its lower half followed by a pale ochreous line from just beyond middle of inner margin toward apex, angled below vein 7 and retracted to costa, the costal area curved, dark brown outwardly, followed by a white comma-shaped streak; forewing with the toothed dark brown commencement of the submarginal line a costal blotch with center of ground color; cell spot minute; fringe pale chestnut.

*Hindwing*.—With the line antemedian, followed by a distinct pale line; submarginal line marked toward anal angle by patches of dark scales on the veins.

Under side paler, the outer line represented by a paler space.

Thorax and abdomen pale ochreous; head dark gray.

*Expanse of wings*.—36 mm.

*Locality*.—Bolivia; 1 male.

*Type*.—Cat. No. 9425, U.S.N.M.

#### MICROGONIA CUBANA, new species.

*Forewing*.—Male dull reddish brown, rather grayer, and with a few striae along costa; a very obscure, diffuse dark line at one-third of costa, not reaching inner margin; a minute black cell dot; outer line slightly paler, marked on veins by dashes of dark and light scales, from two-thirds of inner margin, nearly straight toward apex, before which, on vein 7, it is acutely angulated and retracted to costa, blackish, edged below by a whitish curved streak; at the angle on vein 7 the line is met by a vertical dark streak from costa; area immediately beyond outer line with a faint lilac tinge, with an obscure dentate-lunulate edge indicating submarginal line; fringe concolorous.

*Hindwing*.—Colored like forewing; the line central and hardly traceable; costal area paler, with some dark striae; and oblong diffusely edged black blotch on costa before apex, touching externally the black commencement of submarginal line; hind margin and fringe deeper brown.

Under side dull brick-red, black speckled, with a red-brown marginal border, inwardly edged with dull blackish; apex of forewing narrowly paler beyond submarginal line.

Head and thorax red-brown; abdomen paler; vertex snow-white; forelegs fuscous.

*Expanse of wings*.—50 mm.

*Locality*.—Baracoa, Cuba; March, 1902.

*Type*.—Cat. No. 9426, U.S.N.M.

#### MICROGONIA FOEDARIA, new species.

*Forewing*.—Dingy fawn-color tinged with olive, with scattered olive striae, first line diffuse, olive, at one-third, bent on subcostal, then vertical, slightly outcurved above and below median vein; a minute black cell spot followed by a very diffuse median shade; outer line

olive, double, from three-fifths of inner margin toward apex, before which, on vein 7, it is angled and retracted to costa; the costal streak broadly olive; the line has a decided bend just above vein 2; on the costa it is followed by a brown edged spot externally bilobed; a deeper olive shade from vein 4 to anal angle, containing angulated marks on veins, the inner margin before it somewhat paler with more distinct striations; fringe olive.

*Hindwing*.—With basal area paler, the line central, the marginal area olive-tinged, with distinct dark zigzag submarginal shade; marginal edge pale before the fringe.

Under side pale stone-color, with very slight gray freckling; line dark olive, paler edged; marginal area of forewing with a diffuse olive cloud.

Head dark gray; thorax and abdomen pale fawn-color; legs ochreous, banded with fuscous.

*Expanse of wings*.—39 mm.

*Locality*.—Peru.

Distinguished by its dingy appearance.

*Type*.—Cat. No. 9427, U.S.N.M.

**MICROGONIA PUNCTILINEA, new species.**

*Forewing*.—Pale stone-gray, with a few minute black scales and some sparse olive striæ; the two lines marked by dark olive points on the veins, the olive lunules between them being very obscure; the first line forms two indistinct outward curves on each side of the median vein; the costal streak of outer line is thick and brownish olive; the line is angled on vein 6, then oblique to vein 2, then vertical; it is preceded between veins 3 and 4 by a slight gray cloud and followed on vein 3 by a dark wedge-shaped mark, with two fainter ones on veins 2 and 1 toward anal angle; beyond outer line on costa a large ochreous and brown dark-edged costal blotch; fringe olive, the margin before it linearly whitish; cell spot black.

*Hindwing*.—With denser olive striæ; the postmedian line denticulate; a submarginal olive zigzag line in lower half of wing, followed at anal angle by a dark olive shade.

Under side duller, with obscure striæ; cell spots black, distinct; outer line hardly marked; forewing darker along hind margin, but whitish at apex; fringe brown.

Head, collar, and palpi blackish gray; abdomen like wings; shoulders and patagia almost white; legs ochreous, with black mottlings; antennæ black, with pale cilia.

*Expanse of wings*.—48 mm.

*Locality*.—Rio Sogo, Bolivia (Garlepp). Much resembles *cyclopeata* Moeschler.

*Type*.—Cat. No. 9428, U.S.N.M.

**MICROGONIA UNIFORMIS**, new species.

*Forewing*.—Uniform coffee-color; the lines hardly darker and very obscure; the first at one-third, nearly vertical; the outer from four-fifths of costa, where it is followed by a faint pale spot, oblique outward and angled on vein 7, then straight and oblique to three-fifths of inner margin, with faint pale dots on veins; fringe concolorous; cell spot dark, inconspicuous.

*Hindwing*.—With the line just beyond middle and a dark cell spot.

Under side paler, except the marginal borders and fringe; cell spots distinct.

Thorax and abdomen like wings; head gray-brown.

*Expanse of wings*.—48 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 female, September, 1904.

*Type*.—Cat. No. 9429, U.S.N.M.

**MICROGONIA VESPERTILIO**, new species.

*Forewing*.—Olive, with a diffuse deep olive median shade beyond the black cell spot; a darker olive vertical line at one-third, faintly outcurved above and below the median vein; outer line olive-brown internally, pinkish gray externally, faintly paler marked on veins, from apex to just beyond middle of inner margin; the line appears to be really angled on vein 7 and retracted to costa, but this part is obscured by the deep olive apical tint; marginal area somewhat paler, with a slight gloss; submarginal line indicated by dark white-tipped points on veins; fringe concolorous; costal edge not colored.

*Hindwing*.—With the line continued slightly before middle, bent on vein 6.

Under side paler, shot with lilac-gray, becoming olive in the marginal areas; both wings with dark crenulate postmedian line and black cell spots; apex of forewing and the costa broadly pale brown.

Head, thorax, and abdomen concolorous with wings; fillet narrowly whitish; antennæ ferruginous; legs dull olive yellowish, finely black speckled.

*Expanse of wings*.—78 mm.

*Locality*.—Jalapa, Mexico; 1 male.

Costa of forewing convex; apex shortly and bluntly protruding.

*Type*.—Cat. No. 9430, U.S.N.M.

**MICROGONIA XANTHOPEPLA**, new species.

*Forewing*.—Dull deep yellow, with transverse olive-fuscous striæ, thickest toward hind margin; costal edge near base fuscous; lines olive fuscous; first considerably interrupted, from one-third of costa to two-fifths of inner margin, outcurved above and below median; outer line

from five-sixths of costa, where it is followed by a white spot, shortly oblique to vein 7, where it is angled and runs obliquely curved to three-fifths of inner margin; followed by white dashes on veins; the narrow central area paler yellow and less striated; cell spot black; fringe concolorous.

*Hindwing*.—With the line faint and antemedian, all but touching the small cell spot; basal area paler.

Under side uniform dull yellow, paler than upper side and without striations except along a slightly darker marginal space; cell spots small and dark.

Head brown; thorax and abdomen deep yellow like forewings; under side and legs pale yellow, without dusting, like wings beneath.

*Expanse of wings*.—44 mm.

*Locality*.—St. Jean, Maroni River, French Guiana.

Belongs to the group containing *trychiata* and *trapezata* Guenée. The antennæ are armed with sessile fascicles of cilia.

*Type*.—Cat. No. 9431, U.S.N.M.

#### Genus MIMOGONODES Warren.

##### MIMOGONODES? SUBSIGNATA, new species.

*Forewing*.—Yellowish testaceous, thickly speckled with fuscous; the costa deeper scaled; first line marked only by three black dots on the veins; median shade rust-color, inconspicuous, from two-thirds of costa beyond middle of inner margin, lunulate-dentate, the lunule between veins 2 and 3 fuscous and followed by a blotch of fuscous scales; outer line from five-sixths of costa to three-fourths of inner margin, marked by black vein dots; the dot on vein 5 displaced base-ward, that on vein 2 lost in the blotch of median line; a dot also on inner margin; cell mark pale rust-color, extending along the discocellular, minute black dots at the vein ends; fringe concolorous.

*Hindwing*.—Without first line; the median shade passing over cell spot.

Under side yellowish straw-color, speckled with fuscous; a broad dark fuscous fascia from three-fourths of costa to anal angle, projecting a spur to margin above vein 4; the outer line marked on its outer edge at costa and curving inward from its inner edge at vein 3; a broad dark line from cell mark to inner margin; these markings less extensive in hindwing.

Face and terminal segment of palpi dark brown; vertex, thorax, and abdomen concolorous with wings; legs, palpi, and antennæ all straw-color.

*Expanse of wings*.—40 mm.

*Locality*.—Aroa, Venezuela; 1 female.

Closely allied to *M. fuliginosa* Warren from Peru, but with an indistinct brown median line replacing the straight distinct bar in that species.

*Type*.—Cat. No. 9432, U.S.N.M.

Genus MIMOSEMA Warren.

MIMOSEMA DORSILINEA, new species.

*Forewing*.—Dark fawn-color with a reddish tinge and dense fuscous speckling; costal edge rufous, without striæ, lines reddish; first from one-fourth of costa to near middle of inner margin, slightly concave outward, inwardly edged with a flesh-colored line; outer line from three-fourths of costa to two-thirds of inner margin, also slightly concave outward and outwardly edged with a flesh-colored line; submarginal line obscurely indicated by dark marks between the veins; cell spot dark; fringe red at base edged with flesh-color, the tips again becoming gray.

*Hindwing*.—With only the outer line.

Under side pale ochreous, with blackish speckling except along inner margin; cell spots distinct; outer line indicated; forewings with reddish submarginal cloud from costa; the apex pale gray with dark dusting.

Head, thorax, and abdomen like wings; a flesh-colored dorsal stripe from front of thorax to anal tuft which is grayish ochreous.

*Expanse of wings*.—34 mm.

*Locality*.—Carabaya, southeast Peru; 1 male.

Nearest to *M. imitans* Warren from Panama; distinguished by the dorsal stripe and red costa.

*Type*.—Cat. No. 9433, U.S.N.M.

Genus MYCHONIA Meyrick.

MYCHONIA EXCISA, new species.

*Forewing*.—Dark grayish fawn-color speckled with black, central area browner; lines brown; first from nearly one-third of costa to two-fifths of inner margin, slightly outcurved above and below the median vein, the inward teeth marked on the whitish vein points; outer line from four-fifths of costa; shortly outcurved and angled sharply on vein 7, then oblique to two-thirds of inner margin; edged outwardly especially on veins, with whitish, which forms a white spot on costa; a dark cell spot; fringe concolorous.

*Hindwing*.—With the outer line central.

Under side paler, grayish speckled with black and slightly rufous tinged in the forewing; marginal area fuscous, with the apex gray; hindwing whitish, gray speckled; hind marginal area fuscous; cell

spots black, outer line shown by black spots on veins and marked by a whitish spot on costa.

Head, thorax, and abdomen concolorous with wings.

*Expanse of wings*.—28 mm.

*Locality*.—Cordoba, Mexico; 1 female.

*Type*.—Cat. No. 9434, U.S.N.M.

Genus NEMATOCAMPA Guenée.

NEMATOCAMPA FALSA, new species.

*Forewing*.—Pale ochreous, with a slight rufous-olive flush, and finely dusted with reddish and purplish atoms; costa purplish, two purplish oblique streaks from costa at two-fifths and three-fourths, representing the two lines, which are marked by a rufous dot on submedian vein at one-third and three-fourths; cell spot purple; submarginal line indicated by a rufous blotch below vein 6 and a slighter one at anal angle; marginal line deep purple; fringe ochreous mottled with purplish.

*Hindwing*.—With an olive shade beyond middle, narrow on inner margin, and swelling out in middle, containing a purple cell spot and speckled with red; marginal line and fringe as in forewing.

Under side whitish ochreous; costa of forewing and hind margin of both wings purplish, and a purplish shade from costa to hind margin before apex of forewing; cell spots purplish, small.

Head, thorax, and abdomen like wings; dorsum with pairs of red spots; vertex purple.

*Expanse of wings*.—21 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, April, 1904.

This species mimics the Sterrhid genus *Hæmalea*.

*Type*.—Cat. No. 9435, U.S.N.M.

Genus NEODONTOPERA, new genus.

*Forewing*.—With hind margin elbowed at vein 3 and 6.

*Hindwing*.—With hind margin rounded, crenulate.

Antennæ of male strongly bipectinate, the pectination sciliated; palpi hairy; second segment thick, terminal short, bent forward; tongue and frenulum well developed.

*Neuration*.—Forewing, cell more than half as long as wings; discocellular vertical, very fine; median and subcostal veins both inbent toward end of cell; first median nervule at three-fourths, second shortly before third; lower radial (vein 5) from top end of discocellular, just below 6; 7, 8, 9 stalked, 10, 11 free; hindwing, with costal and subcostal approximating for half of cell; 7 well before end.

*Type*.—*Neodontopera cinerea*, new species.

**NEODONTOPERA CINEREA**, new species.

*Forewing*.—Ashy gray, coarsely scaled; with an outer dark line from four-fifths of costa to shortly before anal angle, slightly bent on vein 6, the marginal area beyond it paler gray; fringe pale gray, slightly darker beyond veins; an inner curved line at one-fourth.

*Hindwing*.—With outer line only; the margin darker; two black marginal dots before anal angle.

Under side paler gray, the outer lines showing whitish.

Head, thorax, and abdomen gray; face darker.

*Expanse of wings*.—38 mm.

*Locality*.—Guadalajara, Mexico; 1 male.

*Type*.—Cat. No. 9436, U.S.N.M.

**Genus NUMIA** Guenée.**NUMIA ALBISECTA**, new species.

*Forewing*.—White, more or less overlaid with gray, green, and vinous scales; a dark olive spot on costa close to base, which itself is white; a dark line from one fifth of costa to one-third of inner margin, outcurved below the median vein and there preceded by a vinous tint; outer line broad, snow-white at two-thirds, incurved at middle, angled outward on submedian fold, and rayed outward along veins below costa; the median area green, mixed with whitish above median line which is wholly white; submarginal line irregular in outline, but forming a strong angle outward on vein 6 touching hind margin; the space before it green, beyond it gray; a dark green square subapical spot; fringe dark gray in basal half, checkered with white in outer half; cell spot white, ringed with dark green.

*Hindwing*.—Dull brick-red, with the inner margin paler and ochreous; fringe ochreous-gray.

Under side pale reddish, coarsely black speckled; forewing with traces of the dark markings and a pale blotch at middle of inner margin; inner margin of hindwing wholly white, with some dark scales at margin before anal angle.

Head, thorax, and abdomen pinkish ochreous, speckled with dark; base of abdomen with a white ring; legs mottled with darker; meta-thorax with a dark spot at middle.

The above description was made from a perfect female; the male is more lilac-gray, without the dark green and vinous shades of the female; the antennae pinkish ochreous, both shaft and pectinations dusted with darker.

*Expanse of wings*.—Male 22 mm.; female 24 mm.

*Locality*.—Baracoa, Cuba; December, 1902.

*Type*.—Cat. No. 9437, U.S.N.M.

Genus *PATALENE* Herrich-Schaeffer.*PATALENE SORDIDA*, new species.

*Forewing*.—Dark fawn-color, with a few black speckles and striæ; lines brown; the first pale and indistinct, from one-third of costa, oblique outward and bent in cell, then vertical to three-fifths of inner margin; outer line narrower, darker brown, from just before apex, shortly oblique outward, bent on vein 7, then oblique to three-fifths of inner margin; fringe brown; cell spot dark green with paler scales round it.

*Hindwing*.—With the line nearly central.

Under side pale fawn, with dark striæ, the marginal area slightly deeper.

Head, thorax, and abdomen concolorous.

*Expanse of wings*.—24 mm.

*Locality*.—Jamaica; 1 male.

Apex of forewings nearly rectangular.

*Type*.—Cat. No. 9438, U.S.N.M.

Genus *PERICLINA* Guenée.*PERICLINA CERVINA*, new species.

*Forewing*.—Male pale fawn, covered with very fine linear transverse darker striæ; lines hardly visible, but marked by faint dark dots on veins; first from one-fourth of costa to one-third of inner margin; outer from five-sixths of costa to two-thirds of inner margin, straight with a slight curve only below costa; cell spot obscure; fringe concolorous.

*Hindwing*.—With the line just beyond middle, marked by dots; cell spot very faint.

Under side pinkish ochreous, paler than above with scarcely any specklings; outer line fairly distinct from costa to middle on forewing only.

Head, thorax, and abdomen like wings.

Female darker, without the pink flush of the male; the striæ darker; both lines dark and clear, as is the cell spot, the veins slightly darker; hindwing the same; under side more speckled than in male, with the outer line distinct; head and body grayish fuscous.

*Expanse of wings*.—40 mm.

*Localities*.—Jalapa, Mexico; 1 male: Costa Rica; 1 female.

Closely allied to *P. arge* Druce (*Sabulodes*).

*Type*.—Cat. No. 9439, U.S.N.M.

Genus *PERO* Herrich-Schaeffer.*PERO BINASATA*, new species.

*Forewing*.—Grayish olive in basal and marginal areas, dark olive shaded with brown in the median; basal patch on costa pale gray with dark gray streaks; costal area of median space lilac-gray, with short dark striæ, the pale area running out as an oblique tooth along upper half of discocellular; inner edge of fascia, as usual, incurved above median and less prominently below; outer edge vertical from three-fourths of costa, bent at right angles on vein 5 and forming a deep sinus containing small lunules to vein 1 where it forms a second, more acutely angled projection, it is edged with whitish, most clearly at costa and preceded by a faint dark parallel line; marginal area with three pale curved streaks; one from costa at edge of fascia to hind margin at end of vein 3, bent on vein 6; a second, shorter, curved from fascia above vein 2 to anal angle; the third wedge-shaped beyond the tooth on vein 1; black submarginal dots in paler spaces; traces of dark wedge-shaped marks on veins 2, 3, and 4 beyond fascia; apical area brown tinged.

*Hindwing*.—Dull olive; pale along costa and tinged with fulvous toward anal angle; a pale outer line, bluntly angled on the cell fold, preceded by a deeper olive tint; inner marginal area with long fulvous hairs; submarginal spots large, distinct.

Under side smooth lilac-gray, with a slight pink flush, costal area of forewing and whole of hindwing before outer line with black striæ; outer line whitish; cell spots large and black, that on forewing bent and containing a fine angled mark on discocellular; marginal area olive-green; with a fulvous apical patch beyond outer line on forewing and at anal angle of hindwing; a whitish patch on forewing from anal angle to vein 4 and along hind margin in hindwing.

Head, thorax, and abdomen olive-gray; anal tuft olive-brown; beyond a paler dorsal space.

*Expanse of wings*.—35 mm.

*Locality*.—Rockstone, Essequibo, British Guiana; 1 male, September, 1904.

Forewing slightly toothed at apex and vein 6, hindwing without teeth; antennæ ciliated.

*Type*.—Cat. No. 9440, U.S.N.M.

*PERO DISJUNCTA*, new species.

*Forewing*.—Male olive-gray in basal and marginal areas, thickly covered with olive-fuscescens striations, which are darker and partially suffused in the former; median area dull chestnut-brown with the striæ plainer along costa where the brown is paler; the lines dark brown; first line from one-fourth of costa forms a rounded projection above median, another vertically below it and a third above inner

margin; the outer line from costa at quite three-fourths runs obliquely inward to vein 7 forming an indentation inward on veins 6 and 1, and a shallow sinus from upper to lower fold preceded throughout by a deeper brown shade; a diffuse brown patch at apex and gray clouds above anal angle; a small black white-tipped dot before margin above and below vein 6, and another below vein 3; cell spot formed of two small white spots, the upper one oblique, the lower minute.

*Hindwing*.—Dark fuscous, with a dark slightly crinkled line at two-thirds; marginal space below middle pale ochreous tinted and striated with brown and black; fringe brown.

Female browner, with much fewer striations; the outer line more irregular, being slightly indented at each vein, the chestnut shade before it more defined; in the marginal area it is followed from vein 6 to the lower fold by a connected series of blackish teeth on the veins; the apical brown shade is better defined and reaches vein 3; and the submarginal spots are larger.

Under side of both sexes gray-brown, mottled with fuscous and pale; outer line ochreous with dark inner edge, nearly straight in forewing, irregularly waved in hindwing and swelling out into a large pale patch in lower half, followed by a bright brown cloud at anal angle; marginal area of forewing darker brown with a pale patch on margin above anal angle preceded by some blackish suffusion; cell spots of both wings ochreous.

Head, thorax, and abdomen brown, the last pale brown, with a blackish dorsal mark on segment 5 in the female; the anal segment in the male whitish ochreous.

*Expanse of wings*.—Male, 36 mm.; female, 39 mm.

*Localities*.—Rockstone, Essequibo, British Guiana; 1 male, September, 1904; St. Jean, Maroni River, French Guiana; 1 female, October, 1904.

The dentations in the female are usually much more prominent than in the male; the hindwings in both sexes are regularly crenulate and denticulate.

The antennæ of the male are shortly pubescent.

*Type*.—Cat. No. 9441, U.S.N.M.

**PERO FCEDA, new species.**

*Forewing*.—Dull olive-ochreous, black speckled; the basal area filled with gray-brown; the central with olive-brown below the middle and before outer line; first line at one-third, curved above and below median vein; the curve above it filled up with blackish forming a small blotch; cell spot gray with a brown ring; preceded by an unspeckled patch of ochreous extending to costa, which is striated with brown; outer line from two-thirds of costa to three-fifths of inner margin, lunulate between veins, and with a sinus from fold to fold, followed on costa by a pale spot; marginal area with coarse black speckles, and

with a cluster of these beyond outer line below middle; some irregular olive clouds along hind margin and round apex; the three top submarginal spots large, black with white tips, the lower ones small and black; fringe olive.

*Hindwing*.—With a dark, pale edged, waved line at two-thirds, before which the brown suffusion is darkest; cell spot annular; marginal area below middle pale ochreous with black speckling, the extreme margin olive; fringe dark brown.

Under side wood-brown, speckled with blackish; the outer line black with pale edges, in the forewing hardly waved, in the hindwing strongly; cell spot of forewing white; of hindwing a black-edged annulus; inner marginal half of forewing whitish.

Head, thorax, and abdomen brown; face and palpi darker; abdomen toward anus mixed with ochreous; legs dark brown mottled with whitish.

*Expanse of wings*.—27 mm.

*Locality*.—St. Laurent, Maroni River, French Guiana; 1 male, January, 1905.

*Type*.—Cat. No. 9442, U.S.N.M.

#### Genus *POLLA* Herrich-Schaeffer.

##### *POLLA ALBIPUNCTA*, new species.

*Forewing*.—Pale olive gray-brown; the costal edge ochreous dotted with short dark streaks; a very indistinct curved line near base with paler spots on veins, plainer on inner margin; a small brown cell spot; a white costal streak at two-thirds, oblique outward and angled above vein 6, then inwardly oblique and below middle curved outward to three-fifths of inner margin, marked by white dashes on veins; first before the apex an inwardly oblique white streak nearly meets the angle of outer line; fringe rather darker than ground color with whitish basal line and white tips.

*Hindwing*.—Darker toward hind margin, crossed at middle by a nearly straight line of white vein dashes; fringe with pale tips only.

Under side with a broad dull brown-gray border, paler than upper side, with the outer apical white streak shown; the rest of the wings paler, dull bluish gray.

Head, thorax, and abdomen like wings; fillet and vertex streaked with white; forelegs mottled dark brown and ochreous.

*Expanse of wings*.—36 mm.

*Locality*.—Paraguay; 1 male. Antennæ strongly ciliated; hind margins of both wings bluntly bent at middle. Nearest to *P. voraria* Schaus.

*Type*.—Cat. No. 9443, U.S.N.M.

## Genus PYRINIA Hübner.

## PYRINIA ÆMULA, new species.

*Forewing*.—Deeply yellow, with a few red-brown speckles; costa finely black dotted; a large brown blotch toward end of cell, and two smaller in an oblique line below it beneath median and submedian, respectively, represent the first line, which rises from a smaller brown spot at one-third of costa; outer half of wing chestnut-brown, the outer line thick from near apex to middle of inner margin, separated by a small lustrous spot on costa from the submarginal line which curves to anal angle, but both these lines are obscured; fringe brown.

*Hindwing*.—With the line slightly antemedian followed by a diffuse fulvous shade; submarginal line formed of elongated olive-fulvous patches on the veins, the apex itself being browner; fringe yellow.

Under side similar; but the interval between outer and submarginal lines of forewing filled up with patches of pale lilac scales; the marginal area from apex to above anal angle being yellowish; hindwing with a broad ferruginous marginal border; the antemedian line thick and the yellow ground-color much speckled with brown.

Head, thorax, and abdomen deep yellow; posterior segments of dorsum dull fulvous.

*Expanse of wings*.—24 mm.

*Locality*.—Bolivia; 1 male.

Distinguished from *P. vanidosa* Dognin by the broad, dark border of hindwings beneath.

*Type*.—Cat. No. 9444, U.S.N.M.

## PYRINIA ALBILINEATA, new species.

*Forewing*.—Olive-brown to the oblique outer line, beyond semilustrous violet-gray; costal edge pale ochreous with black dots; first line marked by two dull dark blotches, one in cell at two-fifths, the other below it and a smaller one on inner margin; all three traversed by an obscure strongly waved lustrous line; outer line fine, slightly lustrous from five-sixths of costa to three-fifths of inner margin; an indistinct submarginal shade to anal angle; fringe olive.

*Hindwing*.—With the line central; the outer half of wing sublustrous; an obscure dark shade from before apex to anal angle; fringe olive; costal area pinkish.

Under side olive-yellow, brighter in hindwing; inner margin of forewing white; striae red-brown, thicker in forewing; a waved brown submarginal line, outwardly edged by a bright white line, expanded into a triangle apically below the yellow costa; marginal area deep chestnut-brown; fringe olive-fuscous; hindwing with a slightly curved fine central and broad submarginal line deep brown; marginal area orange; fringe olive-fuscous.

Head and shoulders purple; apical half of shoulders olive; thorax and patagia and dorsum olive-brown; anal tuft, abdomen at side and beneath, and the legs yellow.

*Expanse of wings.*—27 mm.

*Locality.*—St. Laurent, Maroni River, French Guiana; 1 male, December, 1904.

Allied to *P. sublustraria* Walker. Hind margin of forewing straight and oblique; of hindwing strongly rounded.

*Type.*—Cat. No. 9445, U.S.N.M.

**PYRINIA INSULA, new species.**

*Forewing.*—Pale lilac-gray, tinged strongly with olive and covered with purplish specks and striæ; the two lines starting from thick costal blotches at one-third, and two-thirds; first slight, waved, and thick to one-third of inner margin; the outer oblique outward to vein 6, then becoming obsolete, ending as a narrow oblique streak from vein 2 to inner margin at two-thirds, the interval obscured by an olive suffusion; submarginal line represented by four purplish blotches on veins 1, 2, 3, 4, obsolete above; fringe dark olive with a yellow line along base; the whole basal area slightly darker.

*Hindwing.*—Yellower, with purplish striations, but little dusting; a straight middle line and a marginal shade, the latter swollen and purplish at apex; fringe yellow, purplish at apex.

Under side fulvous with red-brown striæ; the two lines of forewing marked by thickened striæ and slight blotches; a narrow marginal shade, connected with outer line by a horizontal streak along vein 5; hindwing with the line and marginal shade as above.

Head, thorax, and abdomen olive, speckled with reddish; fifth segment of dorsum with a dark ring; under side and legs yellow.

*Expanse of wings.*—17 mm.

*Locality.*—Cayenne, French Guiana; 1 male.

Nearest to *P. brunneata* Warren from the Amazons, but smaller and with finer markings.

*Type.*—Cat. No. 9446, U.S.N.M.

**PYRINIA PRÆFULVATA, new species.**

*Forewing.*—Deep chestnut-brown, showing traces of darker transverse striæ in places; lines darker; first from one-third of costa to two-fifths of inner margin, curved above and waved below middle; outer line from just before apex all but straight to two-thirds of inner margin followed by a faint pale line, plainer at costa and on inner margin; costal edge bright olive-ochreous with fine black points; fringe concolorous.

*Hindwing.*—With the line central; fringe bright chestnut.

Under side bright orange-fulvous, with brown striæ, which in hindwing are confined to the basal area; lines of the upper side marked

more broadly, the pale edging of the outer line broadening and semi-lustrous toward costa; black striæ forming a shade from middle of outer line to anal angle; fringe dark brown; hindwing with a dark-brown mark at apex and slight submarginal line from it.

Head, thorax, and abdomen chestnut-brown, with a slight olive tint; shoulders olive; abdomen at sides bright fulvous; beneath with the legs deep yellow; palpi fulvous, the terminal segment blackish.

*Expanse of wings*.—30 mm.

*Locality*.—Bolivia; 1 male.

*Type*.—Cat. No. 9447, U.S.N.M.

Genus *SYNCRENIS*, new genus.

*Forewing*.—With apex slightly produced; hind margin strongly toothed at middle.

*Hindwing*.—With hind margin hardly bent at middle, rounded; both angles distinct.

Antennæ of male simple, lamellate; palpi quite short; tongue and frenulum present; hind tibiæ swollen, with a pencil of hairs and four short spurs.

*Neuration*.—In forewing the two radials rise together from the upper end of cell; veins 7, 8, 9 are stalked from before end; 10 anastomoses with 11, which rises from 12.

*Type*.—*Syncrenis ustimargo*, new species.

*SYNCRENIS USTIMARGO*, new species.

*Forewing*.—Ochreous at base, with numerous speckles, passing into fulvous brown before outer line; first line from one-fourth of costa to one-fourth of inner margin, angled in cell before the black cell spot; pearl-gray, edged with black scales; outer line from close before apex, shortly outcurved, sharply angled on vein 7, then straight to four-fifths of inner margin; pale lustrous; marginal area with a large black cloud below middle; fringe brown; with darker basal line.

*Hindwing*.—Without first line; the pearly line nearly central beyond the black cell spot; marginal area gray-brown; the whole freckled with black.

Under side pale brownish ochreous speckled with black; cell spots black; the outer line marked by black spots on veins; marginal area fuscous, paler toward apex of forewings.

Head, thorax, abdomen, and legs all ochreous.

*Expanse of wings*.—26 mm.

*Locality*.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

*Type*.—Cat. No. 9448, U.S.N.M.



## A NEW SALAMANDER FROM NORTH CAROLINA.

By LEONHARD STEJNEGER,

*Curator, Division of Reptiles and Batrachians.*

A very strikingly colored salamander, plumbeous with brick-red legs, was recently presented to the Museum by Mr. C. S. Brimley, of Raleigh, North Carolina. It was collected by Mr. F. Sherman, jr., the entomologist, on August 24, 1904, near the extreme western corner of North Carolina, less than 20 miles from the border of Tennessee, between Andrews and Aquone, both of which localities are on streams draining into the Little Tennessee River.<sup>a</sup>

The tongue and other external characters, as well as the whole physiognomy of the animal, are so much like those of a *Plethodon*, and so different from *Desmognathus*, that I have not considered it necessary to mutilate the unique specimen in order to ascertain the character of the vertebræ.

### PLETHODON SHERMANI, new species.

*Diagnosis.*—Parasphenoid patches of teeth separated; tongue large, posterior half free; fourteen costal folds; vomero-palatine teeth in two short, oblique series, not extending outward beyond the inner nares, widely separated behind and from the parasphenoid patches; tail very long, much longer than head and body, slender, and tapering to a fine point; color plumbeous, the legs brick-red in strong contrast.

*Habitat.*—Mountains of western North Carolina.

*Type.*—Cat. No. 36214, U.S.N.M.; Nantahala Mountain, between Andrews and Aquone; Mr. F. Sherman, jr., collector; August 24, 1904.

<sup>a</sup> In a letter dated December 28, 1905, Professor Sherman, upon inquiry, gave the following more detailed information about the type locality: "I am morally certain that I took the specimen by side of rocky, shaded streamlet in the forest on the eastern (Aquone) side of the ridge [between Andrews and Aquone], more than half way to the summit, tho' I can now only dimly recall the exact place and circumstances. There are cool streamlets on that side of the ridge where I stopped to drink. That ridge must be about 4,500 feet at the summit, and is a branch of the Nantahala mountain or group of mountains."

*Description of type.*—Adult: Vomeropalatine teeth (fig. 1) in two short, oblique, curved series, which do not extend outward beyond the choanæ, each series consisting of five to six rather large teeth; the distance between the series posteriorly equals about three-fourths of the length of the series; distance of vomeropalatine series from parasphenoid patches greater than length of series; parasphenoid teeth in two narrowly though distinctly separate patches, the teeth rather large, arranged in parallel, oblique rows, about five in each row; tongue very large, filling the entire floor of the mouth, thin, posterior half free, anterior portion narrowly attached along the median line; snout slightly projecting beyond lower jaw, rounded, truncate, or even slightly concave between the nostrils; distance between the latter equals the interorbital space and their distance from the eyes; a distinct groove from posterior margin of nostril to the edge of the lip, slightly oblique toward the front; a deep groove from posterior angle of eye along side of neck to the gular fold, another groove descending

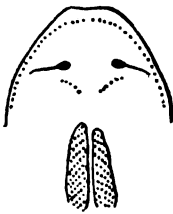


Fig. 1.

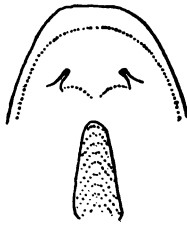


Fig. 2.

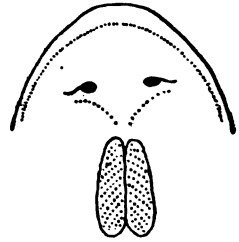


Fig. 3.

FIG. 1.—DENTITION OF *PLETHODON SHERMANI*. U. S. N. M. No. 36214. 3 × NAT. SIZE.

FIG. 2.—DENTITION OF *PLETHODON ANEUS*. U. S. N. M. No. 16660. 3 × NAT. SIZE.

FIG. 3.—DENTITION OF *PLETHODON JORDANI*. U. S. N. M. No. 35597. 3 × NAT. SIZE.

vertically from it behind the angle of mouth to the posterior end of the mandible; gular fold very deep, ascending on the sides of the neck; distance from tip of snout to gular fold contained about four times in distance to vent and about twice and a third times in distance between axilla and groin; limbs well developed, tips of fingers and toes nearly meeting when pressed along the sides of the body; digits not dilated at tips; fingers (fig. 4) well developed except inner, which is almost rudimentary, third much longer than second, which is longer than fourth; inner toe (fig. 5) very small, fourth longest, slightly longer than third, second and fifth subequal; tail slender, tapering to a point, subcylindric anteriorly, slightly compressed posteriorly, longer than head and body by the width of the head; fourteen strongly marked costal grooves, with one above and behind the insertion of the fore leg, and one above and in front of the hind leg, none of which descend to the lower surface. Color in life said to be "uniformly plumbeous with brick-red legs;" in alcohol, the color above and on the sides is bluish plumbeous, the whole surface under the magnifying glass showing a uniform dusting over of minute

pale dots as in *Plethodon glutinosus*; underside pale gray with a glow of salmon color, strongest on throat; legs pale salmon color, the upper side of hands and feet finely dusted with dark grey, which color also forms a distinct bar across the elbows and the knees.

*Dimensions.*

|                              | mm.  |
|------------------------------|------|
| Total length .....           | 104  |
| Snout to vent .....          | 48   |
| Vent to tip of tail .....    | 56   |
| Snout to gular fold .....    | 11.5 |
| Axilla to groin .....        | 27   |
| Greatest width of head ..... | 7    |
| Fore leg .....               | 13   |
| Hind leg .....               | 15   |

*Remarks.*—The direct relationship of this new salamander is not easy to trace. In the coloration of its legs it resembles very strongly the Californian *Plethodon croceater*, which also has a long tail, but here the similarity ends, for the shape of the head and the dentition as described by Cope are entirely different, besides many other discrepancies in relative length of toes, of limbs, and in number of costal folds, etc.

With our common eastern *Plethodon glutinosus* the new species has very little in common except the minute, pale, dust-like sprinkling of the dark skin. The proportions are entirely different, *P. shermani* being much slenderer with a much longer and slenderer tail, while the dentition is still more at variance, *P. glutinosus* having the vomero-palatines extending beyond the choanæ and a single, undivided parasphenoid patch. The fifth toe is also relatively much longer than in *P. glutinosus*.

The proportions of *P. æneus*, on the other hand, are similar, except those of the head, which in this species is broad and squarish. The tail, also long and slender, is more cylindric though less tapering toward the tip. The hands and feet are also very different, being very broad and the digits distinctly widened at the tips (fig. 6). The coloration, moreover, is radically different and the dentition almost as much so, for while in *P. shermani* the teeth are large and few, the vomero-palatine series short, unusually far apart behind and placed far away from the distinctly divided parasphenoid patches, in *P. æneus* (fig. 2) the teeth are small and very numerous, the vomero-palatine series long, unusually close together behind and the parasphenoids on an undivided patch. Finally, while in the former the choanæ are large, in the latter they are uncommonly small.

Were it not that *P. jordani* (fig. 3) has the parasphenoid patches divided by a narrow groove we would scarcely have needed mention it in this connection, inasmuch as proportions and dentition otherwise is sufficiently different. It is a much stouter built animal and the teeth

much smaller, more closely approximated, and more numerous. Thus the vomero-palatine series are long and close together behind, the distance between them being less than one-third the length of the series, while externally they extend beyond the choanæ. Moreover, they contain ten to eleven teeth as against five to six in *P. shermani*.



Fig. 4.



Fig. 5.



Fig. 6.

FIG. 4.—UPPER SIDE OF RIGHT FORE FOOT OF PLETHODON SHERMANI. U.S.N.M. No. 36214. 3 × NAT. SIZE.

FIG. 5.—UNDERSIDE OF RIGHT HIND FOOT OF PLETHODON SHERMANI. U.S.N.M. No. 36214. 3 × NAT. SIZE.

FIG. 6.—UNDERSIDE OF RIGHT HIND FOOT OF PLETHODON ÆNEUS. U.S.N.M. No. 16660. 3 × NAT. SIZE.

I have added camera lucida sketches of the dentition of the two last-mentioned species, which are still rare in collections, so that the differences from our new species can be seen at a glance.

Mr. F. Sherman, jr., has done considerable to increase our knowledge of the salamander fauna of North Carolina, and I therefore take great pleasure in naming this discovery of his after him.

## CAMBRIAN FAUNAS OF CHINA.<sup>a</sup>

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By CHARLES D. WALCOTT,

*Curator, Division of Stratigraphic Paleontology.*

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### INTRODUCTION.

In the first paper on the Cambrian Faunas of China<sup>b</sup> a historical introduction was given along with a list of the species known at the date of the publication of the paper.

During the summer of 1905 a box of fossils, that had been lost, was received in Washington. This material was collected by Mr. Eliot Blackwelder under the direction of Mr. Bailey Willis, principally from the provinces of Shen-si and Shan-si. It has afforded a number of new species, but has not added otherwise materially to our knowledge of the Cambrian faunas of China except in the case of the occurrence of the genus *Coscinoocyathus*.

The illustrations for the report on the Cambrian faunas of China, collected by Messrs. Willis and Blackwelder, are now well advanced, and it is anticipated that the full report, including descriptions of genera and species and paleontological correlations and illustrations, will be published before the close of 1906.

When preparing the preliminary notes on the Cambrian faunas of China<sup>b</sup> in 1905, I had not noticed that H. Monke had published a paper on the Geology of Shan-tung, and described certain "Upper" Cambrian trilobites.<sup>c</sup> It was not until February 27, 1906, that the Jahrbuch containing the paper arrived at the United States Geological Survey library.

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<sup>a</sup> Preliminary Paper No. 2.

<sup>b</sup> Proc. U. S. Nat. Mus., XXIX, Sept., 1905, pp. 1-106.

<sup>c</sup> Beiträge zur Geologie von Schantung. I. Obercambrische Trilobiten von Yentsy-yai. Jahrb. d. K. P. Geol. Landesanst. und Bergakad. zu Berlin, XXIII, Pt. 1, 1903, pp. 103-151.

The following is a list of the genera and species described by H. Monke:

- |                                 |                                      |
|---------------------------------|--------------------------------------|
| 1. <i>Agnostus koerferi</i> .   | 5. <i>Drepanura premesnili</i> .     |
| 2. <i>Liostracina krausei</i> . | 6. <i>Drepanura ketteleri</i> .      |
| 3. <i>Teinistion lansi</i> .    | 7. <i>Stephanocare richthofeni</i> . |
| 4. <i>Teinistion sodeni</i> .   | 8. <i>Stephanocare</i> sp.           |

Of the above three genera and species described by me in 1905 are synonyms:

*Liostracina krausei* Monke = *Ptychoparia ceus* Walcott.

*Teinistion lansi* Monke = *Dorypygella typicalis* Walcott.

*Stephanocare richthofeni* Monke = *Damesella chione* Walcott.

The following are new forms:

*Drepanura ketteleri* Monke.

*Teinistion sodeni* Monke.

I do not find that *Agnostus koerferi* Monke differs specifically from *Agnostus chinensis* Dames.

*Teinistion lansi* Monke is similar in many respects to *Shantungia spinifera* Walcott, but differs in the presence of an incurved frontal margin, and the absence of the long frontal spine.

The detailed sections worked and the succession of the contained faunas show that the horizon of the fauna described by Monke is the upper part of the Middle Cambrian, and not Upper Cambrian as determined by Monke. The detailed sections and lists of faunas will be given in the paleontological report.

#### ASSOCIATION OF GENERA AND SPECIES.

In order that the student may be saved the labor of making lists of the species from the various localities, the following lists are inserted. The species given in each list do not all occur in the same layer of rock, but they are from the same band of layers. The number of layers and their thickness will be given in Mr. Blackwelder's report on the detailed sections. The stratigraphic range is limited so as to avoid the commingling of faunas from distinct faunal zones.

The line between the Middle and Upper Cambrian faunas is placed at the top of the Ku-shan shale. The fauna of the Ku-shan shale includes species of *Damesella*, *Dorypyge*, and genera that are typical of the Middle Cambrian fauna, while the fauna of the Ch'au-mi-tien limestone, above the Ku-shan shale, is more nearly related to that of the Upper Cambrian of North America and northwestern Europe.

The line of the Lower Cambrian is placed at the top of the Man-t'o formation, as the predominant trilobite, *Redlichia*, is more closely

related to *Olenellus* than to the trilobites of the Middle Cambrian fauna.

|   |  |
|---|--|
| Upper Cambrian..Ch'au-mi-tien formation.....      | Brachiopoda:<br><i>Discinopsis sulcatus.</i>   |
|   | Trilobita:<br><i>Anomocare</i> , species undetermined.<br><i>Anomocarella irma.</i><br><i>Ptychaspis bella.</i>  |
| Middle Cambrian..Ku-shan formation .....          | Trilobita:<br><i>Blackwelderia ciliæ</i> Walcott.<br><i>Agraulos regularis.</i>  |
|   | Anthozoa:<br><i>Coscinocyathus elvira.</i>   |
| Middle Cambrian..Ch'ang-hia (Kí-chóu) formation.. | Brachiopoda:<br><i>Obolus</i> ( <i>Lingulepis</i> ?), species undetermined.<br><i>Yorkia</i> ? <i>orientalis.</i><br><i>Orthis</i> ( <i>Plectorthis</i> ) <i>agreste</i> , <i>O. (P.) kichouensis</i> ,<br><i>O. (P.)</i> , species undetermined.  |
|   | Gastropoda:<br><i>Scenella</i> ? <i>dilatatus.</i><br><i>Platyceras willisi.</i><br><i>Stenotheca</i> ?? <i>simplex.</i>   |
|   | Trilobita:<br><i>Dorypyge richthofeni levis.</i><br><i>Agraulos armatus</i> , <i>A. nitida</i> , <i>A. obscura</i> , <i>A. uta</i> ,<br><i>A. vicina.</i><br><i>Agraulos</i> (?) <i>a capax</i> , <i>A. (?) melle.</i><br><i>Anomocare bigbyi</i> , <i>A. erioptia</i> , <i>A. flava.</i><br><i>Anomocarella contigua.</i><br><i>Ptychoparia comus</i> , <i>P. inflata</i> , <i>P. lilia</i> , <i>P. nerets</i> ,<br><i>P. undata</i> , <i>P. vesta</i> , <i>P.</i> , species undetermined.<br><i>Ptychoparia</i> (?) <i>maia.</i><br><i>Ptychoparia</i> ( <i>Liostracus</i> ) <i>intermedia</i> , <i>P. (L.) subrugosa.</i><br><i>Solenopleura pauperata.</i><br><i>Dolichometopus hyrie.</i> |

\* Interrogation points within parentheses indicate undetermined subgenera.

TABLE SHOWING GEOLOGIC AND GEOGRAPHIC DISTRIBUTION OF THE FAUNA.

|  | Horizons. |    |    | Localities.        |                 |                     |                    |                            |             |                  |                |
|--|-----------|----|----|--------------------|-----------------|---------------------|--------------------|----------------------------|-------------|------------------|----------------|
|  | L.        | M. | U. | Near Wu-t'ai-hiën. | Near Tai-an-fu. | Near Fang-lan-chón. | Near Tung-yü-chón. | Yao-to, near Wu-t'ai-hiën. | Ch'ang-hia. | Near Yen-chuang. | Ch'au-mi-tien. |
| ANTHOZOA.  |           |    |    |                    |                 |                     |                    |                            |             |                  |                |
| <i>Coscinocyathus elvira</i> , new species.....                            |           | ×  |    | ×                  |                 |                     |                    |                            |             |                  |                |
| BRACHIOPODA.   |           |    |    |                    |                 |                     |                    |                            |             |                  |                |
| <i>Obolus</i> ( <i>Lingulepis</i> ?), species undetermined.....            |           | ×  |    |                    |                 | ×                   |                    |                            |             |                  |                |
| <i>Discinopsis sulcatus</i> , new species.....                             |           |    | ×  |                    | ×               |                     |                    |                            |             |                  |                |
| <i>Yorkia</i> ? <i>orientalis</i> , new species.....                       |           | ×  |    |                    |                 |                     | ×                  |                            |             |                  |                |
| <i>Orthis</i> ( <i>Plectorthis</i> ) <i>agreste</i> , new species.....     |           | ×  |    |                    |                 |                     |                    |                            |             |                  |                |
| <i>Orthis</i> ( <i>Plectorthis</i> ) <i>kichouensis</i> , new species..... |           | ×  |    |                    |                 |                     |                    |                            | ×           |                  |                |
| <i>Orthis</i> ( <i>Plectorthis</i> ) , species undetermined.....           |           | ×  |    |                    | ×               |                     | ×                  |                            | ×           |                  |                |

TABLE SHOWING GEOLOGIC AND GEOGRAPHIC DISTRIBUTION OF THE FAUNA—Cont'd.

|   | Horizons. |    |    | Localities.        |                  |                     |                    |                            |             |                  |                |   |
|---|-----------|----|----|--------------------|------------------|---------------------|--------------------|----------------------------|-------------|------------------|----------------|---|
|   | Cambrian. |    |    | Near Wu-t'ai-hiën. | Near T'ai-an-fu. | Near Fang-lan-chôn. | Near Tung-yü-chôn. | Yao-to, near Wu-t'ai-hiën. | Ch'ang-hia. | Near Yen-chuang. | Ch'au-mi-tien. |   |
|   | L.        | M. | U. |                    |                  |                     |                    |                            |             |                  |                |   |
| GASTROPODA.   |           |    |    |                    |                  |                     |                    |                            |             |                  |                |   |
| <i>Scenella? dilatatus</i> , new species.....                 |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>Platyceras willisi</i> , new species.....                  |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |
| <i>Stenotheca? simplex</i> , new species.....                 |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| TRILOBITA.  |           |    |    |                    |                  |                     |                    |                            |             |                  |                |   |
| <i>Dorypyge richthofeni larvis</i> , new variety.....         |           | x  |    |                    |                  | x                   | x                  |                            |             |                  |                |   |
| <i>Blackwelderia ciliis</i> Walcott.....                      |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |
| <i>Agraulos armatus</i> , new species.....                    |           | x  |    | x                  |                  |                     |                    |                            |             |                  |                |   |
| <i>nitida</i> , new species.....                              |           | x  |    | x                  |                  |                     |                    |                            |             |                  |                |   |
| <i>obscura</i> , new species.....                             |           | x  |    | x                  |                  | x                   |                    |                            |             |                  |                |   |
| <i>regularis</i> , new species.....                           |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |
| <i>ula</i> , new species.....                                 |           | x  |    | x                  |                  |                     |                    |                            |             |                  |                |   |
| <i>vicina</i> , new species.....                              |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>Agraulos (?) capax</i> , new species.....                  |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>(?) melie</i> , new species.....                           |           | x  |    | x                  |                  |                     | x                  |                            |             |                  |                |   |
| <i>Anomacare bigsbyi</i> , new species.....                   |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>eriptia</i> , new species.....                             |           | x  |    |                    |                  |                     |                    |                            | x           |                  |                |   |
| <i>flava</i> , new species.....                               |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |
| species undetermined.....                                     |           |    | x  |                    |                  |                     |                    | x                          |             |                  |                |   |
| <i>Anomacarella contigua</i> , new species.....               |           | x  |    |                    |                  |                     |                    |                            |             | x                |                |   |
| <i>irma</i> , new species.....                                |           |    | x  |                    |                  |                     |                    | x                          |             |                  |                |   |
| <i>Ptychaspis bella</i> , new species.....                    |           |    | x  |                    |                  | x                   |                    |                            |             |                  |                |   |
| <i>Ptychoparia comus</i> , new species.....                   |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>inflata</i> , new species.....                             |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |
| <i>lilia</i> , new species.....                               |           | x  |    | x                  |                  |                     |                    |                            |             |                  |                |   |
| <i>nercis</i> , new species.....                              |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |
| <i>undata</i> , new species.....                              |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>vesta</i> , new species.....                               |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |
| species undetermined.....                                     |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>Ptychoparia (?) maia</i> , new species.....                |           |    |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>Ptychoparia (Liostracus) intermedia</i> , new species..... |           | x  |    |                    |                  |                     |                    |                            |             |                  |                | x |
| <i>Ptychoparia (Liostracus) subrugosa</i> , new species.....  |           | x  |    |                    |                  |                     |                    |                            |             | x                |                | x |
| <i>Solenopleura pauperata</i> , new species.....              |           | x  |    |                    |                  |                     | x                  |                            |             |                  |                |   |
| <i>Dolichometopus hyrie</i> , new species.....                |           | x  |    |                    |                  | x                   |                    |                            |             |                  |                |   |

## ANTHOZOA.

## Genus COSCINOCYATHUS Bornemann.

*Coscinocyathus* BORNEMANN, 1884, Deutsch. geol. Gesell., Zeitsch. XXXVI, p. 704.

**COSCINOCYATHUS ELVIRA**, new species.

This species is represented by one small cup, a fragment of the interior wall of a larger cup, and a thin section showing a portion of the wall and the diagonally transverse section near the base of the cup. The cup has a height of 3 mm., and a diameter of 3 mm. at the aper-

ture. The exterior surface appears smooth under a lens of moderate power, but with a strong lens it is found to be perforated by minute pores; the interior surface is marked by arching ridges, radiating from the base toward the outer edge, connected by transverse ridges, between which rounded pits occur. A diagonally transverse thin section shows the system of ridges described and the openings between them. The same section cuts across near the base of a cup. In this the calcite is so crystallized that no definite structure, with the exception of a few traces of septa extending from the inner wall to the outer wall, can be distinguished.

The fragment illustrating the interior wall indicates a cup that expanded much more rapidly than the cup described above. It may be that a second species is indicated by this, but with the material available for study it does not appear best to attempt to distinguish them by applying distinct names.

When the surface of the outer wall is slightly worn the radiating lines and transverse septa are very clearly shown.

*Observations.*—The generic reference to *Coscinocyathus* is made on account of the presence of the regular cross septa in addition to the radial septa, as defined by Dr. J. G. Bornemann.<sup>a</sup> None of the Siberian forms of the *Archæocyathinæ* described by Dr. Eduard von Toll<sup>b</sup> appears to be closely related to this species.

The specific name is given in recognition of the work of Miss Elvira Wood in the preliminary study of the Cambrian fauna of China.

*Formation and locality.*—Middle Cambrian, in a brownish gray, partly oolitic limestone, in a horizon corresponding to the lower portion of the Ch'ang-hia formation of Shan-tung; 4.5 miles south of Wu-t'ai-hiën, Shan-si, China.

Collected by Eliot Blackwelder.

## BRACHIOPODA.

Genus OBOLUS Eichwald.

LINGULEPIS Hall, subgenus of OBOLUS.

OBOLUS (LINGULEPIS?), species undetermined.

This species is represented by a few fragments, one of which shows that the ventral valve is elongate, and the apex acuminate. The shell was built up of several layers or lamellæ, as in characteristic forms of *Obolus* and its subgenera. The interior surface of some of the lamellæ is marked by fine, radiating, and concentric striæ; the outer surface, under a strong magnifier, shows fine, concentric, somewhat irregular striæ.

<sup>a</sup> Deutsch. geol. Gesell. Zeitsch., XXXVI, 1884, p. 704.

<sup>b</sup> Mém. de l'Acad. Imp. des Sciences de St.-Petersb., 8th ser., VIII, No. 10, 1899.

*Formation and locality.*—Middle Cambrian, lower portion of oolitic limestone series; 4 miles east of Fang-lan-chōn, Shan-si, China.

Collected by Eliot Blackwelder.

Genus DISCINOPSIS Matthew.

*Acrotreta?* MATTHEW, 1885, Illustrations of the Fauna of the St. John Group, No. 6, p. 37.

*Discinopsis* (MATTHEW MS.) HALL and CLARKE, 1892, Pal. New York, VIII, Pt. 1, pp. 105, 167.

The original diagnosis of the genus is as follows:

“*Diagnosis.*—Shell subcircular in outline. Surface depressed-conical, apices excentric, not marginal. Pedicle-valve with the apex truncated by a circular foraminal aperture(?). The interior of this valve is characterized by a pair of deep, diverging furrows, passing forward from the beak or internal foraminal opening, in broad curves which converge toward the anterior margin but without meeting. These furrows enclose a thickened and somewhat elevated central area, which, in the subumbonal region is apparently free, projecting for a short distance, like a narrow, triangular shelf, beneath which the foramen probably opened. The interior opening of the foramen is, however, not apparent on any of the specimens examined, for, as usually preserved, the matrix has adhered to this subapical cavity, and in a single example only, is the shelf-like character of the median area distinctly demonstrated. A faint longitudinal ridge passes from the apex of the shelf to the anterior margin, but no other markings are discernible on the interior except faint radiating or slightly undulating, probably vascular lines.

“The interior of the brachial valve, as far as known, shows no other characters than the radiating lines, which appear to belong to the ornamentation of the outer surface.

“Shell-substance tenuous, apparently corneous. External surface covered with more or less prominent, sometimes lamellose concentric growth-lines, crossed by fine, gently curved, radiating striæ which are usually more prominent when the concentric lines are exfoliated.

“Type, *Discinopsis gulielmi* Matthew.”

DISCINOPSIS SULCATUS, new species.

*Cramiella?* sp. WALCOTT, 1905, Proc. U. S. Nat. Mus., XXIX, pp. 4, 6.

This species is based upon the cast of the interior of a small ventral valve, that in its interior markings closely approaches the interior of the ventral valve of *Discinopsis gulielmi* Matthew.<sup>a</sup>

The interior cast shows that the ventral valve was subcircular in outline, moderately convex, and with the apex probably perforated

<sup>a</sup> Illustrations of the Fauna of the St. John Group, 1885, No. 6, p. 37.

by a small, circular foraminal aperture. In front of the cast of the base of the foraminal aperture there is a broad depression that extends to the front margin; on each side of the central depression an elongate, slightly depressed area extends forward and outward from near the base of the cast of the foraminal aperture, along the ridge on each side of the median depression; back of the base of the foraminal aperture there is a narrow, short, arched furrow that indicates the presence of a corresponding ridge on the interior of the shell. No other markings are shown on the cast, except the faint outline of what may have been the visceral area, on the median line in front of the base of the foraminal aperture and between the broad vascular sinuses.

*Observations.*—This species is referred to the genus *Discinopsis* as the result of comparison with specimens of the interior of a ventral valve of *D. gulielmi*. One interior of the latter species has scars much like those in *D. sulcatus*.

*Formation and locality.*—Upper Cambrian, upper part of Ch'au-mitien limestone; Pagoda Hill, 1 mile west-southwest of T'ai-an-fu, Shan-tung, China.

Collected by Eliot Blackwelder.

#### Genus YORKIA Walcott.

*Yorkia* WALCOTT, 1897, Proc. U. S. Nat. Mus., XIX, p. 714.

#### YORKIA? ORIENTALIS, new species.

This species is represented by a single small ventral valve, which has the external characteristics of *Yorkia wanneri*, of the Lower Cambrian.<sup>a</sup> The outline of the valve is transversely and broadly oval in outline, exclusive of the apex rising above the posterior margin; the apex gives a subtriangular outline to the valve when looking down upon it; the apex is moderately elevated, and projects over the posterior margin; it is perforated by a rather large aperture just above a small false area.

The surface of the valve is marked by low, rather broad, concentric undulations, a few fine, concentric striæ, and a very finely reticulate ornamentation, formed by the crossing of oblique, elevated, curved lines, which form slightly elongate, diamond-shaped pits between them. Shell substance apparently calcareous. Width of ventral valve, 2.5 mm.; length, 2 mm. at aperture, 2.25 mm. at apex; elevation, 0.5 to 0.75 mm.

*Observations.*—As far as may be determined by the exterior of the valve this species is properly referred to *Yorkia*. The generic reference, however, will remain in doubt until information is available as to the characters of the interior of the valve.

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<sup>a</sup>Proc. U. S. Nat. Mus., XIX, 1897, p. 715, pl. LX, fig. 1.

*Formation and locality.*—Middle Cambrian, central portion of Ki-chóu formation, in a dark gray limestone; 4 miles south-southwest of Tung-yü-chôn, Shen-si, China.

Collected by Eliot Blackwelder.

Genus ORTHIS Dalman.

**PLECTORTHIS** Hall and Clarke, subgenus of ORTHIS.

**ORTHIS (PLECTORTHIS) AGRESTE**, new species.

Shell transverse, subsemicircular; a ventral valve 9 mm. in length has a width of 12 mm., and a hinge line 10.5 mm. in length; ventral valve moderately and regularly convex, with the apex curved down to an area that is slightly inclined backward from the hinge line; the details of the cardinal area are unknown.

Surface marked by rounded, radiating ribs and interspaces, 6 ribs in a space of 3 mm. near the front margin; a few of the ribs bifurcate, but most of them extend from the umbo to the front margin; the ribs are crossed by fine, concentric striæ and strong lines of growth.

*Observations.*—This shell is characterized by its regular convexity and the uniformity of the rounded, radiating ribs.

*Formation and locality.*—Middle Cambrian, near base of the Ch'ang-hia formation in dirty gray, fossiliferous limestone; 1 mile east-southeast of Ch'ang-hia, Shan-tung, China.

Collected by Eliot Blackwelder.

**ORTHIS (PLECTORTHIS) KICHOUENSIS**, new species.

This species is represented by a specimen of the dorsal valve. The outline of the shell is transversely rounded subquadrilateral; length, 9 mm.; width, 13 mm.; the highest point above the plane of the margin is about 3 mm. above the hinge line; a shallow median sinus begins at the umbo, and gradually widens toward the front margin; back of the umbo the shell extends beyond the hinge line, and then recedes to the beak, which apparently is at or a little over the upper edge of a very narrow area.

Surface marked by numerous radiating, rounded ribs, with narrow interspaces, 7 ribs in a distance of 5 mm.; a few bifurcations of the ribs occur at irregular intervals between the apex and the margins. There are no traces of concentric striæ; if on the shell originally, they have been removed by the wearing off of the outer surface.

*Observations.*—This species is distinguished from all other species by the strong, incurved umbo, and rounded ribs with narrow interspaces.

*Formation and locality.*—Middle Cambrian, in lower part of Ki-chóu formation, in brown-gray, oolitic limestone; 4.5 miles south of Wu-t'ai-hiën, Shan-si, China.

Collected by Eliot Blackwelder.

## ORTHIS (PLECTORTHIS), species undetermined.

This species is represented by a single specimen of the ventral valve. Ventral valve convex, with the apex curving gently downward from the highest point to the cardinal area; transverse; length, 2.5 mm.; width, 3 mm.; hinge line a little shorter than the greatest width; cardinal area sloping slightly backward from the hinge line.

Surface marked by about 16 strong, nearly regular, rounded, radiating ribs, that are crossed by fine, concentric striae, lines of growth, and one strong ridge indicating interruption of growth.

*Observations.*—This little shell was at first placed with *Orthis* (*Plectorthis*) *agreste* (p. 570), but further study showed that its greater convexity, elevated apex, and stronger ribs distinguished it from that species.

*Formation and locality.*—Middle Cambrian, upper portion of Ch'ang-hia formation, near top of dark, oolitic limestone series; 2 miles north-northeast of Ch'ang-hia, Shan-tung, China.

A larger shell of this type occurs in Shen-si, in the central portion of the Ki-chou formation. It has a length of 6.5 mm., and a width of 7.5 mm. The surface is marked by numerous radiating ribs, similar to those of the shell from Ch'ang-hia, also concentric striae and several ridges resulting from interruption of growth.

The locality is 4 miles south-southwest of Tung-yü-chön, Shen-si, China.

A third shell, that appears to be a dorsal valve, was found in limestone pebbles in river gravel. The surface is partially exfoliated, but it shows rounded, radiating ribs and concentric ridges, similar to those on the two specimens described above.

The associated fragments of trilobites suggest the Middle Cambrian fauna.

The locality is in the railroad grade, one-third mile west of west city gate, Tai-an-fu, Shan-tung, China.

Collected by Eliot Blackwelder.

## GASTROPODA.

Genus SCENELLA Billings.

SCENELLA? DILATATUS, new species.

This species is based upon two specimens which preserve the expanded outer margin, but not the elevated, central, conical portion of the shell. The exterior outline is oval, the length of the type specimen being 9 mm.; width, 7 mm. The surface on the inner side of the campanulate margin is marked by numerous radiating, elevated striae. As viewed from the lower side the margin slopes gently inward to a shallow depression, or furrow, within which there is a rounded, slightly ele-

vated ridge, that extends around the border of the elevated portion of the shell, except on what is supposed to be the posterior side; on this side the curvature from the margin across the border to the elevated portion of the shell is uninterrupted.

A second specimen occurs in the collection which shows the exterior surface. This is smooth, and corresponds in surface configuration approximately to the reverse of the specimen above described. Unfortunately it is in a very fragmentary state, neither the outline of the margin nor the central, elevated portion being preserved.

*Observations.*—This species is distinguished by the broad, campanulate-like border; it differs from *Scenella clotho* Walcott<sup>a</sup> in its smooth, exterior surface, and the strong, radiating striae on the inner surface, both the outside and inside of the shell of *S. clotho* being marked by concentric striae and lines of growth.

*Formation and locality.*—Middle Cambrian, lower portion of Kichou formation, in a brown, oolitic limestone; 4 miles south-south-west of Tung-yü-chön, Shen-si, China.

Collected by Eliot Blackwelder.

#### Genus PLATYCERAS Conrad.

#### PLATYCERAS WILLISI, new species.

Shell minute, consisting of two whorls somewhat irregularly incurved; the apex and one side of the aperture lie in the same plane; the outer whorl increases in size gradually through its first half, and then expands more rapidly toward the aperture; a cross section of the outer whorl shows the dorsal (outer) side to be gently convex, and the inner side somewhat more strongly convex, a rounded dorsal angle being formed where the two sides unite on the outer edge.

The surface is marked by concentric lines of growth parallel to the aperture.

The greatest diameter of the largest shell is 1.6 mm.

*Observations.*—This species differs from *Platyceras chronus* Walcott<sup>b</sup> in having a more slender, rounded, outer whorl, without trace of the dorsal ridge characteristic of that species. It differs from *P. clytia* Walcott<sup>b</sup> in being coiled on the plane of the dorsal side instead of on the plane of the median line.

*Formation and locality.*—Middle Cambrian; in greenish gray limestone, interbedded in argillaceous shales; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

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<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 12.

<sup>b</sup>Idem, p. 14.

## Genus STENOTHECA Salter.

## STENOTHECA ?? SIMPLEX, new species.

Shell small, depressed conical, with the apex situated about one-sixth the distance from the front to the posterior margin; the point of the apex is broken away; aperture subcircular, and little broader than long.

Surface concentrically striated, with a trace of a shallow furrow extending from the apex toward the central portion of the anterior margin.

The greatest diameter of the type and only specimen is 2 mm.

*Observations.*—This species differs widely from other known species from China. It may be compared with some varieties of the young of *Stenotheca rugosa*, but it differs in the aperture being broader, and not having a rugose surface. The continuous concentric striæ and absence of any indication of an area show that it is a gasteropod, but its generic reference is doubtful.

*Formation and locality.*—Middle Cambrian, lower portion of Ki-chôu formation, in a brown, oolitic limestone; 4 miles south-southwest of Tung-yü-chôn, Shen-si, China.

Collected by Eliot Blackwelder.

## TRILOBITA.

## Genus DORYPYGE Dames.

## DORYPYGE RICHTHOFENI LÆVIS, new variety.

This variety is characterized by a nearly smooth surface. An associated pygidium and heads of *D. richthofeni* Dames<sup>a</sup> have tubercles over most of the surface.

*Formation and locality.*—Middle Cambrian; 4 miles east of Fang-lan-chôn, Shan-si; and 4 miles south-southwest of Tung-yü-chôn, Shen-si, China.

Collected by Eliot Blackwelder.

## Genus BLACKWELDERIA, new genus.

*Genotype.*—*Blackwelderia sinensis* Bergeron.<sup>b</sup>

## BLACKWELDERIA CILIX Walcott.

*Olenoides ? cilix* WALCOTT, 1905, Proc. U. S. Nat. Mus., XXIX, p. 27.

This species is represented by numerous specimens of the central portions of the head, separated free cheeks, and associated specimens

<sup>a</sup> China, Richthofen, IV, 1883, p. 24.

<sup>b</sup> *Calymmene ? sinensis* BERGERON, 1899, Bull. de la Soc. Géol. de France, 3d ser., XXVII, p. 500.

of the pygidium. These indicate that the general form of the head was transversely semicircular, and rather strongly convex, and that the margin of the head was of medium width in front, gradually widening to the free cheek, where it narrows toward the base of the postero-lateral spine. A postero-lateral spine projects backward and slightly upward from a point on the margin a little in advance of the postero-lateral angle. Glabella truncato-conical in outline, and marked by three pairs of furrows, the posterior of which extends obliquely backward nearly to the occipital furrow; the anterior furrows are indicated by short, slight depressions on the edges of the glabella next to the dorsal furrow; they are situated so as to divide the space between the posterior furrows and the front margin of the glabella into subequal spaces; a very narrow, slightly indicated, median, longitudinal ridge extends from the occipital furrow nearly to the front of the glabella; occipital furrow strongly marked, rounded, and about as wide as the occipital segment; occipital segment of medium width, convex, and arching forward slightly at the center; a shallow furrow crosses it on each side so as to outline a rounded node at each end; dorsal furrow rounded, rather strong at the ends, and merging into the broad concave slope of the frontal limb.

Fixed cheeks about one-half the width of the glabella; they rise abruptly from the dorsal furrow to the base of the palpebral lobes, and slope rapidly from the palpebral lobes backward to the posterior furrow, and more rapidly to the front, where they merge into the concave frontal limb; palpebral lobes small, elevated, separated from the fixed cheeks by a shallow furrow, and situated opposite the central part of the head; ocular ridges indicated by depressed lines that extend from the anterior end of the palpebral lobes, across the fixed cheeks, to the dorsal furrow; postero-lateral limb about one-third the width of the head within the facial sutures; it is marked by a broad, shallow furrow within the narrow posterior margin; frontal limb broad, concave, and rising with a gentle curvature from the front of the glabella to the margin of the thickened frontal rim.

Free cheek roughly subtriangular; it is divided into an interior, convex body, which rises from the furrow at its base to the small eye lobe at its center; the border of the head is crossed obliquely by a sharp ridge that extends from its inner, anterior side, backward to its outer side, where it forms the outer edge of a sharp spine; the border extends backward to the postero-lateral angle of the cheek, and inward to the facial suture; a strong spine originates a little in advance of the postero-lateral angle and extends obliquely backward.

The associated pygidium is subsemicircular; axial lobe strong, and tapering gently from the front toward its rounded termination; it is divided by five well defined, deep transverse furrows, that cross it from side to side, and a sixth posterior furrow that crosses only its

upper portion; the furrows divide the axis into five segments, or rings, and the subtriangular terminal portion, that slopes rapidly from its center to the thickened border; lateral lobes broad, convex, and marked by a narrow, anterior, elevated segment, which joins the thorax, and three strong, narrow, elevated ridges, and a small node terminating a fourth ridge; the ridges are separated by broad, strong furrows that are continuations of the furrows crossing the axis; the thickened border is separated from the body of the pygidium by a shallow groove; from the border there are backward extending spines on each side of the central axis, the second of which, on each side of the axis, is longer and stronger than the others.

Surface of the crust of the head, free cheeks, and pygidium, and associated fragments of the segments of the thorax minutely punctate. The largest head in the collection has a length of 20 mm., with the same width at the palpebral lobes; the largest pygidium has a width of 35 mm. and a length of 18 mm., exclusive of the spines.

*Observations.*—The character of the frontal limb and rim of this species is quite like that of the type of the genus, *Blackwelderia sinensis* Bergeron.<sup>a</sup> There is a difference in the surface, as there are no tubercles known on the surface of *B. cilix*.<sup>b</sup> On account of the general resemblance between the heads and pygidia of the genera *Damesella* and *Blackwelderia* we may compare species of the two genera. We find in *B. sinensis* Bergeron a form of head and surface somewhat intermediate between *Damesella blackwelderi*<sup>c</sup> and *B. cilix*. The surface of *B. sinensis* is minutely punctate like that of *B. cilix*, and in addition it has scattered pustules of the character of those so thickly dispersed over the surface of *D. blackwelderi*. The frontal limb of *B. sinensis* is somewhat intermediate in form between that of *B. cilix* and *D. blackwelderi*. If the border of *B. sinensis* were a little more thickened we should have the appearance of the frontal rim or border of *D. blackwelderi*. One of the specimens of *B. sinensis* has a frontal limb and border somewhat like that of *B. cilix*.

The form of the glabella of *B. cilix* is similar to that of *B. sinensis* Bergeron, but the frontal limb is much broader than in that species, the fixed cheeks narrower and less elevated, and the surface is apparently without granulations.

*Formation and locality.*—Middle Cambrian, in a concretionary, ocherous limestone that may correspond to the Ku-shan shale horizon of the Shan-tung sections; 4 miles east of Fang-lan-chōn, Shan-si, China.

Collected by Eliot Blackwelder.

<sup>a</sup> *Calymmene? sinensis* BERGERON, 1899, Bull. de la Soc. Géol. de France, 3rd ser., XXVII, p. 500.

<sup>b</sup> *Olenoides? cilix* WALCOTT, 1905, Proc. U. S. Nat. Mus., XXIX, p. 27.

<sup>c</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 35.

## Genus AGRAULOS Corda.

## AGRAULOS ARMATUS, new species.

This species is represented by a finely preserved specimen of the central portions of the head, exclusive of the free cheeks. The glabella is strongly convex, with the sides slightly converging toward the rounded front; it is marked by three pairs of short, obscure glabellar furrows close to the dorsal furrow; the occipital furrow is indicated by a short, scarcely discernible depression toward the side of the union of the glabella and occipital ring; occipital ring a little narrower than the glabella and extended backward into an extraordinarily strong spine, that is nearly as broad as the glabella to a point corresponding in length with the glabella; the posterior termination of the spine is not preserved; on the side view the surface of the glabella extends backward continuously with that of the occipital ring and spine, on the same plane; the strong backward extension of the glabella recalls some of the large occipital spines in some species of *Microdiscus*; dorsal furrow deep, and strongly developed on the sides and in front of the glabella.

Fixed cheeks about as wide as the glabella, strongly convex, and merging into a convex frontal limb that is wider and more convex than the fixed cheeks; palpebral lobes small; a narrow, clearly defined ocular ridge extends obliquely backward across the fixed cheek from the antero-lateral angle of the glabella.

Surface minutely granular under a very strong lens. The type specimen has a length of 5 mm., exclusive of the combined occipital ring and spine.

*Observations.*—This species is most nearly related to *A. (?) melie* (p. 581) and *A. acalle* Walcott.<sup>a</sup> It differs from them in the form of the convex fixed cheeks and frontal limb, the presence of ocular ridges, the extraordinarily strong occipital spine, and in having a proportionately shorter glabella.

*Formation and locality.*—Middle Cambrian, in brownish gray, oolitic limestone, 10 feet above red shales of supposed Man-t'o formation age; 4.5 miles south of Wu-t'ai-hsien, Shan-si, China.

Collected by Eliot Blackwelder.

## AGRAULOS NITIDA, new species.

This species is represented by the central portions of the head, exclusive of the free cheeks; the front within the facial sutures is strongly rounded, indicating a semicircular outline for the head, which was moderately convex. Glabella truncato-conical, moderately convex, and not very clearly defined from the fixed cheeks and frontal limb; there are no traces of glabellar furrows; occipital furrow repre-

<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 43.

sented by a slight depression at the base of the glabella; occipital ring very narrow at the sides, thickening rapidly toward the center so as to give it a subtriangular outline, the apex of which terminates in a small spine of unknown length; dorsal furrow indicated by the difference in slope of the glabella and fixed cheeks and frontal limb.

Fixed cheeks less than one-half the width of the glabella, nearly flat opposite the palpebral lobes, and sloping gently downward to the posterior furrow, and to the front to merge into the frontal limb, which is slightly convex; palpebral lobes about one-fourth the length of the head.

Surface slightly roughened by what appears to be a minutely granulated surface as shown by a strong lens.

The largest head in the collection has a length of 5 mm.

*Observations.*—This species is most nearly related to *Agraulos dolon* Walcott.<sup>a</sup> The head of the latter differs in being longer in proportion to the width, and in having broader fixed cheeks.

*Formation and locality.*—Middle Cambrian, in brownish-gray, oolitic limestone, 10 feet above red shales of supposed Man-t'o formation age; 4.5 miles south of Wu-t'ai-hiën, Shan-si, China.

Collected by Eliot Blackwelder.

#### AGRAULOS OBSCURA, new species.

This species is represented by the central portions of the head, exclusive of the free cheeks. The glabella and fixed cheeks moderately convex; glabella truncato-conical, with the front margin gently curved, and antero-lateral angles slightly rounded; the postero-lateral angles are more broadly rounded and pass into the line of the posterior margin of the occipital ring without interruption by the occipital furrow; surface of glabella smooth, with the exception of some very slight indications of a posterior pair of furrows; occipital furrow shallow, and dying out before reaching the dorsal furrow; occipital ring narrow at the ends, broadening and rising toward the center to form the base of what may be a short spine, or a slight upward projection of the central portion of the posterior margin of the ring; dorsal furrow of medium width and well defined at the sides and front of the glabella.

Fixed cheeks narrow, convex, rising into narrow ridges that anteriorly form a node or swelling where they merge into the frontal limb, posteriorly they slope down to merge with the postero-lateral limb; palpebral lobes small, somewhat elevated, and separated from the fixed cheeks by a shallow furrow; there does not appear to be any ocular ridge; postero-lateral limb about as long as the width of the glabella in front; it is marked by a shallow furrow within the slightly rounded posterior margin; frontal limb and rim in front of the

<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 45.

glabella moderately convex; on each side a broad, shallow furrow indicates that the dividing line between the frontal limb and rim was about half way between the front of the glabella and the frontal margin of the head.

Surface apparently smooth. The type specimen of the head is 7.5 mm. in length.

*Observations.*—This species indicates a type that is best represented by *Agraulos* (?) *melie* (p. 581). It differs from the latter in not having a swollen frontal limb, in the absence of ocular ridges, and in having a smaller, flat occipital ring. From *Agraulos divi* Walcott<sup>a</sup> this species differs in the presence of the side furrows delimiting the frontal limb and rim, narrower and more convex fixed cheeks, and less strongly marked occipital ring.

*Formation and locality.*—Middle Cambrian, lower portion of oolitic limestone series; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

#### AGRAULOS REGULARIS, new species.

This species is represented by a few specimens of the central portions of the head, exclusive of the free cheeks. These indicate that the head was rather strongly convex, and semicircular in outline. Glabella convex, truncato-conical, rounded in front, and with traces of two pairs of short glabellar furrows that divide it into three subequal portions; occipital furrow narrow but clearly defined; occipital ring narrow at the sides, increasing slightly in width toward the center where it rises to form the base of a small node; dorsal furrow deep and rather broad.

Fixed cheeks convex, rising abruptly from the dorsal furrow, the posterior furrow of the head, and from the anterior margin; in front they merge into the rounded, convex frontal limb with a trace of an intervening furrow and narrow ocular ridge; palpebral lobes small, and situated opposite the central portion of the glabella.

Surface, under a strong lens, shows traces of being very finely punctate. The average length of three specimens of the head is 2 mm.

*Observations.*—The head representing this species has the rounded, full fixed cheeks, and frontal limb of *Agraulos acalle* Walcott,<sup>b</sup> but it differs in having a proportionally shorter and broader glabella, and in being broader between the facial sutures.

*Formation and locality.*—Middle Cambrian, Ku-shan shale horizon of the Shan-tung section, in a fossiliferous, brownish-gray limestone; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 45.

<sup>b</sup> Idem, p. 43.

**AGRAULOS UTA, new species.**

This species is based upon a single head, preserving the glabella and fixed cheeks, and frontal rim. It is of the same type as *Agraulos* (?) *capax* (p. 580), but differs in having a narrower fixed cheek, less convex and swollen frontal limb, and flatter frontal rim. The glabella is without traces of furrows, and the occipital ring is separated from it by a very shallow, scarcely noticeable transverse furrow; the frontal limb is rather broad and slightly swollen in front of the glabella; the general plane of the frontal limb and fixed cheeks is the same from a line drawn through the posterior end of the palpebral lobes.

Surface slightly roughened by a fine network of narrow, slightly elevated, inosculating lines. The type specimen has a length of 5.5 mm.

*Formation and locality.*—Middle Cambrian, Ki-chóu limestone, in brown gray, partly oolitic bed, 10 feet above red shales supposed to correspond to the Man-t'ó shales of the Shan-tung sections; 4.5 miles south of Wu-t'ai-hiën, Shan-si, China.

Collected by Eliot Blackwelder.

**AGRAULOS VICINA, new species.**

This species is represented by three specimens of the moderately convex central portions of the head, exclusive of the free cheeks. Glabella conical, convex, and without traces of glabellar furrows; occipital furrow transverse and clearly defined; occipital ring rather strong, transverse, and slightly convex; dorsal furrow rounded, of medium width, and clearly defined at the sides and front of the glabella.

Fixed cheeks about as wide as the glabella, moderately convex, and sloping forward and slightly downward into the frontal limb; palpebral lobes small, situated opposite the central portion of the glabella; ocular ridges narrow, slightly elevated, and extending from the anterior end of the palpebral lobe to a point corresponding to the antero-lateral angle of the glabella; postero-lateral limb short, and marked by a shallow furrow within its posterior margin; frontal limb short, convex in front of the glabella, arching slightly backward on each side to merge into the fixed cheeks; frontal rim broad, slightly convex, and separated by a shallow, slightly defined furrow at the angle formed by the union of the sloping frontal limb with the nearly flat frontal rim.

Surface roughened as seen by a high magnifying power. The largest specimen in the collection has a length of 3 mm.

*Observations.*—This species is characterized by its narrow, conical glabella, convex frontal limb that merges into the convexity of the fixed cheeks, and the presence of a distinct frontal rim. In the latter respect it approaches *Agraulos* (?) *capax* (p. 580), and *Agraulos uta*

(p. 579). It differs widely from *A. (?) capax* and less so from *A. uta* in its narrow, conical glabella, and the form of its frontal limb.

*Formation and locality.*—Middle Cambrian, in a brown, oolitic limestone, near the base of the Ki-ch'ou limestone, corresponding to the lower portion of the Ch'ang-hia limestone; 4 miles south-southwest of Tung-yü-ch'ön, Shen-si, China.

Collected by Eliot Blackwelder.

**AGRAULOS (?) CAPAX, new species.**

As indicated by the central portions of the head, exclusive of the free cheeks, the head of this species is semicircular in outline, and moderately convex. The glabella narrows slightly from the base to its rounded front, which springs from the point where the ocular ridges pass into the dorsal furrow; the surface of the glabella is marked by three pairs of short, slightly impressed glabellar furrows that divide the glabella into a posterior, subtriangular lobe, two narrow lobes, and a larger, front terminal lobe; occipital furrow rounded, not very deep, and slightly wider at the sides than in the center; occipital ring narrow at the sides, widening toward the center where there is a low, small node near the posterior margin; dorsal furrow narrow, deep in front, and shallow at the sides of the glabella.

Fixed cheeks broad, rising gently from the dorsal furrow to the palpebral lobes; they slope gradually to the posterior furrow, and, in front of the ocular ridges, rather rapidly to the broad furrow defining the frontal limb; palpebral lobe small, narrow, and passing in front into a narrow ocular ridge, which crosses the fixed cheek to the anterolateral angle of the glabella; frontal limb separated from the glabella by a narrow, deep furrow, which widens out on each side; the limb is strongly convex immediately in front of the glabella, where it rises on some examples into a transverse boss; in other specimens it is not much higher than the general elevation of the glabella.

Surface finely punctate under a strong lens. The head of the largest specimen in the collection has a length of 7 mm., with a width of 12 mm. at the palpebral lobes.

*Observations.*—This species, at first sight, might be taken for a broad form of *Agraulos (?) melie* (p. 581), but on closer examination it is seen that the glabella is nearly rectangular instead of truncato-conical, the fixed cheeks are more than twice the width, and glabella narrower, in specimens of the same size. The ocular ridges of *A. (?) capax* are also unlike those of *A. (?) melie*.

*Formation and locality.*—Middle Cambrian, in a brown, oolitic limestone, near the base of the Ki-ch'ou limestone, corresponding to the lower portion of the Ch'ang-hia limestone; 4 miles south-southwest of Tung-yü-ch'ön, Shen-si, China.

Collected by Eliot Blackwelder.

**AGRAULOS (?) MELIE, new species.**

Central portions of head, exclusive of the free cheeks, convex. Glabella truncato-conical, convex, about one-half the length of the head, and marked by three pairs of short, faintly impressed glabellar furrows, and a narrow, median, longitudinal ridge; occipital furrow transverse, rounded, shallow, and fading out toward the center of the glabella; occipital segment narrow at the sides, widening rapidly to the central portion, which is as high as the glabella at the back, and sloping toward the occipital furrow at the base of the glabella; a minute node occurs at the center of the segment; dorsal furrow shallow, but strongly outlined.

Fixed cheeks narrow, elevated at the palpebral lobes, and sloping toward the glabella; a narrow ridge extends from the anterior, outer edge of the furrow on the inner side of the palpebral lobe to the furrow in front of the antero-lateral angle of the glabella, which corresponds to the ocular ridge; palpebral lobe long, narrow, and separated from the fixed cheek by a narrow furrow; frontal limb convex, rising to a prominent boss or swelling in front of the glabella, from which it is separated by a strong furrow; at the sides the frontal limb is narrow, and merged into the narrow fixed cheeks; postero-lateral limbs short, narrow, and separated from the fixed cheeks by a narrow, shallow furrow.

Surface finely punctate under a strong lens. The largest head in the collection has a length of 6 mm.

*Observations.*—This species is characterized by the tumid frontal limb, and the ridge within the palpebral lobe on the fixed cheek, a feature found on *Agraulos*, but not on any of the described forms from China.

*Formation and locality.*—Middle Cambrian, in a brownish gray limestone corresponding to the lower portion of the Ch'ang-hia limestone; 4 miles south-southwest of Tung-yü-chön, Shen-si, and 4.5 miles south of Wu-t'ai-hiën, Shan-si, China.

Collected by Eliot Blackwelder.

**Genus ANOMOCARE Angelin.****ANOMOCARE BIGSBYI, new species.**

Of this species only the central portions of the head, exclusive of the free cheeks, are known. Glabella moderately convex; a glabella 9 mm. in length has a width of 9 mm. at the base and 6 mm. in front; front rounded from the anterior side of the ocular ridges; surface marked by a pair of faintly impressed posterior furrows that extend obliquely backward from the dorsal furrow toward the center; a second pair of furrows is indicated by a smooth place on the surface; occipital furrow very shallow at the center, broader and slightly

deeper toward the sides, with a shallow pit near the dorsal furrow; occipital ring of medium width, very slightly convex; dorsal furrow shallow, but clearly indicated at the sides and front of the glabella.

Fixed cheeks narrow, flat opposite the palpebral lobes; they curve gently down toward the posterior furrow and more abruptly in front; palpebral lobes small, less than one-fifth the length of the head; the marginal rim is prominent, and passes obliquely into the low, broad ocular ridge which crosses the cheek obliquely to the antero-lateral angle of the glabella; frontal limb slightly concave, passing with very slight interruption into the flattened rim, the line of demarcation between the limb and rim being little more than the angle formed by the union of the sloping limb with the more nearly horizontal rim.

Surface minutely granular, the granules being irregularly distributed, and rising abruptly from the general surface. A head 15 mm. in length has the same width at the palpebral lobes.

*Observations.*—This species may be compared with *Anomocare temenus* Walcott,<sup>a</sup> *A. latelimbatus* Dames,<sup>b</sup> and *A. ? daulis* Walcott.<sup>c</sup> From the first it differs in its broader glabella and less distinctly marked line between the frontal limb and rim; from the second it differs in a more rounded glabella, and narrower frontal limb; and from the third in having a more conical glabella and less concave frontal limb. The small palpebral lobe is like that of *Anomocare bergiomi* Walcott.<sup>d</sup> It may be that the two species will be found to belong to another genus.

*Formation and locality.*—Middle Cambrian; 4 miles south-southwest of Tung-yü-chön, Shen-si, China.

Collected by Eliot Blackwelder.

#### ANOMOCARE ERIPIA, new species.

The description of *Anomocare temenus* Walcott<sup>e</sup> covers the principal features of this species. *A. eripia* differs in having a broader fixed cheek, less distinctly defined furrow between the frontal limb and frontal rim, and in the absence of a median ridge on the glabella. The associated pygidium differs from that of *A. temenus* in having a proportionately more convex axis, smaller pleural lobe, and in having the furrows on the pleural lobe extend nearly across the border of the pygidium. *A. eripia* differs from *A. tatian* Walcott<sup>f</sup> in its broader frontal limb, and more depressed frontal limb and border, broader fixed cheeks, and less distinctly defined glabella.

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 53.

<sup>b</sup> China, Richthofen, IV, 1883, p. 14.

<sup>c</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 50.

<sup>d</sup> Idem, p. 47. <sup>e</sup> Idem, p. 53. <sup>f</sup> Idem, p. 53.

*Formation and locality.*—Middle Cambrian, near base of Ch'ang-hia formation in gray, oolitic series; Ch'ang-hia, Shan-tung, China.

Collected by Eliot Blackwelder.

**ANOMOCARE FLAVA, new species.**

Head, exclusive of the free cheeks, quadrilateral, and moderately convex. Glabella slightly convex in front, becoming more convex toward the center, along which there is a very slightly indicated longitudinal ridge. A glabella 6 mm. in length has a width of 5.5 mm. at the base and 4 mm. opposite the anterior edges of the ocular ridges, where the rounded front begins; the posterior pair of glabellar furrows is indicated on one specimen by a slight depression, on another, two pairs of furrows are indicated by slight scars about half way between the center and the sides of the glabella; occipital furrow shallow, scarcely more than indicating the line of division between the glabella and the occipital ring; the latter rises gently toward the center; dorsal furrow clearly indicated at the junction of the glabella and fixed cheeks, and also in front of the glabella.

Fixed cheeks about one-third the width of the glabella, nearly flat back of the ocular ridges, and sloping gently downward to merge into the frontal limb, and backward to the posterior margin of the head; ocular ridges low and rather broad, they terminate at the antero-lateral angles of the glabella from whence they extend obliquely backward to merge into the palpebral lobes; palpebral lobes little more than one-fourth the length of the head, and rather prominent; frontal limb in front of the glabella is about the same width as the frontal rim, it is slightly convex to the base of the rather abrupt posterior margin of the frontal rim.

The surface is marked by a few minute, scattered pores, to be seen only by a strong lens. The largest head has a length of 12 mm., with the same width at the palpebral lobes.

The associated pygidium has a broad, planulate margin, a narrow, convex axis, with six rings, indicated by shallow furrows, and a terminal segment; the furrows on the axis are extended out on the pleural lobes, disappearing on the planulate margin.

*Observations.*—The central portions of the head of this species differ from *Anomocare temenus* Walcott,<sup>a</sup> the nearest related form, in having a shorter glabella in proportion to its width, a tubercle or spine of unknown size on the occipital ring, and a smoother surface on the glabella. The associated pygidium is much like that associated with *A. temenus*, but differs in having a narrower axis marked by more rings.

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<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 53.

*Formation and locality.*—Middle Cambrian, thin-bedded, greenish gray limestone interbedded in ochreous and green, argillaceous shales; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

**ANOMOCARE, species undetermined.**

This form is represented by a fragment of the central portion of a large head much like that of *Anomocare alcinoe* Walcott.<sup>a</sup> The frontal limb and broad rim are similar to those of *Anomocare temenus* Walcott.<sup>b</sup> It is the youngest representative of this type of *Anomocare* as it occurs near the summit of the Cambrian system in China.

*Formation and locality.*—Upper Cambrian, limestone interbedded in green shales; 4 miles southeast of Yaü-t'o, near Wu-t'ai-hién, Shan-si, China.

Collected by Eliot Blackwelder.

**Genus ANOMOCARELLA Walcott.**

*Anomocarella* WALCOTT, 1905, Proc. U. S. Nat. Mus., XXIX, p. 54.

**ANOMOCARELLA CONTIGUA, new species.**

This species is represented by an imperfect specimen of the central portions of the head, and numerous associated pygidia and free cheeks. The head differs from that of *Anomocarella chinensis* Walcott<sup>c</sup> in having a more conical glabella, with the sides converging toward the front, instead of being subparallel. The associated pygidium has a shorter axis than that associated with *A. chinensis*, and a broader, smoother border.

*A. contigua* occurs at the same locality as *A. chinensis*, but at a slightly higher horizon.

*Formation and locality.*—Middle Cambrian, lower central portion of Ch'ang-hia formation, in dense, gray limestone, interbedded in green, nodular shale; 2 miles south of Yen-chuang, Sin-t'ai District, Shan-tung, China.

Collected by Eliot Blackwelder.

**ANOMOCARELLA IRMA, new species.**

This species is represented by two specimens of the central portions of the head. These indicate that the head was semicircular in outline, and moderately convex. Glabella prominent, convex, sides straight and converging gently toward the front which is broadly rounded; the only traces of glabellar furrows are two faint scars near the front, which extend from the outer margin nearly to the median line of the head; occipital furrow well defined, separating a rounded, rather strong occipital ring; dorsal furrow distinctly defined at the sides and less clearly marked in front of the glabella.

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 47.

<sup>b</sup> Idem, p. 53.

<sup>c</sup> Idem, p. 57.

Fixed cheeks narrow, almost lost in the palpebral lobes; in front of the latter they extend forward and downward as narrow, convex ridges, merging into the frontal limb; palpebral lobes strong, about one-third the length of the head; ocular ridge merged into the fixed cheek on the back side and defined by a short, steep slope on the front side; frontal limb of medium width, sloping with very little convexity to the narrow furrow separating the frontal limb from the relatively broad, flattened frontal rim; the length of the latter in front of the glabella is a little more than that of the frontal limb.

Surface slightly roughened by elevated, irregular, more or less inosculating lines upon which numerous minute nodes occur. The result is that on some portions the surface appears to be finely granulose, and on others finely punctate, the interspaces between the inosculating lines giving the punctate appearance and the nodes on the lines the granulose appearance. A head 4.5 mm. in length has the same width at the palpebral lobes, exclusive of the free cheeks.

*Observations.*—The nearest related species is *Anomocarella ? bura* Walcott.<sup>a</sup> It differs from the latter in having a short frontal limb between the glabella and frontal rim, relatively larger palpebral lobes, and a stronger dorsal furrow about the glabella.

*Formation and locality.*—Upper Cambrian, limestone interbedded in green shales; 4 miles southeast of Yaü-t'o, near Wu-t'ai-hiën, Shan-si, China.

Collected by Eliot Blackwelder.

#### Genus PTYCHASPIS Hall.

##### PTYCHASPIS BELLA, new species.

This species is represented by a single specimen of the central portions of the head, exclusive of the postero-lateral limbs and free cheeks. Glabella subrectangular in outline, moderately convex, and crossed by a backward arching furrow which separates a narrow segment from the large anterior lobe, which has a length of 6.5 mm. and a width at the center of 5 mm.; the anterior lobe of the glabella is marked close to the dorsal furrow by very short furrows which indicate the second pair of glabellar furrows; the posterior transverse furrow is rather broad and deep at the sides, becoming somewhat shallower at the center; the posterior segment has a uniform width across the central portions, widening out at the ends in front; occipital furrow transversely rounded and rather deep; occipital ring transverse, slightly convex, and about the same width as the posterior segment of the glabella; dorsal furrow deep and strong at the sides and in front of the glabella.

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 56.

Fixed cheeks narrow and rising abruptly from the dorsal furrow, nearly flat opposite the palpebral lobes; they slope abruptly downward toward the posterior furrow and toward the frontal rim; palpebral lobes narrow, rounded, and separated from the fixed cheeks by strong, narrow furrows; frontal rim convex, prominent, and separated from the glabella by the deep dorsal furrow, and from the fixed cheeks by a narrow, deep furrow that extends obliquely outward and forward from opposite each antero-lateral angle of the glabella.

The surface of the glabella is marked by raised, irregular, more or less inosculating, sharp ridges, the general direction of which is transverse to the axis of the glabella; the fixed cheeks are marked by ridges somewhat like those on the glabella, which are subparallel to the dorsal furrow and the furrow within the palpebral lobes; the ridges on the frontal limb are broken up into large granulations by the inosculating furrows. A head 11 mm. in length has a width of 12 mm. at the palpebral lobes.

*Observations.*—The general form of the central parts of the head of this species suggests *Ptychaspis acamus* Walcott.<sup>a</sup> It differs from the latter in the form of the glabella in front of the transverse glabellar furrow, the elevated lines on the fixed cheeks instead of granulations, and in minor details of the occipital and glabellar furrows.

*Formation and locality.*—Upper Cambrian, blue, dolomitic limestone, probably equivalent to the Ch'au-mi-tien limestone of Shantung; 4 miles east of Fang-lan-ch'ôn, Shan-si, China.

Collected by Eliot Blackwelder.

#### Genus PTYCHOPARIA Hawle and Corda.

##### PTYCHOPARIA COMUS, new species.

Of this species only the central portions of two small heads are known. The glabella and fixed cheeks are convex; glabella convex, truncato-conical, and marked by three pairs of faint furrows; occipital furrow rather broad, rounded, and moderately deep; occipital ring narrow at the sides, widening gradually toward the center, where it is a little elevated above the plane of the glabella and not much wider than the occipital furrow; dorsal furrow clearly defined on the sides and slightly marked in front of the glabella.

Fixed cheeks narrow, not over one-fourth the width of the glabella; palpebral lobes about one-third the length of the head, somewhat nearer the posterior than the frontal margin of the head; ocular ridge short, and not prominent, it terminates a little back of the antero-lateral angle of the glabella; frontal limb narrow, very slightly convex, and sloping downward with a well defined furrow separating it from the strong, rounded, thickened frontal rim; four small, shallow

<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 69.

pits occur in the furrow, one strong one on each side of the center, and one faint one opposite the outer edges of the glabella.

Surface finely granulose under a strong lens. The largest head has a length of 5 mm.

*Observations.*—This species belongs to the forms intermediate between *Ptychoparia* and *Liostracus*. It is distinguished from other species of the Chinese Cambrian by its rounded, strong frontal rim, and very slightly tapering glabella, in the latter respect recalling such forms of *Anomocare* as *A. butes* Walcott,<sup>a</sup> *A. alcinoe* Walcott,<sup>b</sup> and *A. minus* Dames,<sup>c</sup> from the Cambrian of China.

*Formation and locality.*—Middle Cambrian, oolitic limestone; 4 miles south-southwest of Tung-yü-chön, Shen-si, China.

Collected by Eliot Blackwelder.

PTYCHOPARIA INFLATA, new species.

This species is represented by two specimens of the central portions of the head, exclusive of the free cheeks. The parts preserved indicate that the head was rather strongly convex, and semicircular in outline. Glabella moderately convex, with the length and width at the base equal; the sides converge slightly toward the rather broadly rounded antero-lateral angles; front nearly transverse; surface marked by a clearly defined posterior pair of furrows, which extend obliquely inward and backward, separating a subtriangular postero-lateral lobe; a second pair of short, lightly defined furrows occurs about one-third the distance between the posterior furrows and the front of the glabella; occipital furrow rather broad and shallow toward the center, narrower and deeper at the sides; occipital ring narrow at the sides, increasing in width toward the center where it is rather broad, and slightly convex; dorsal furrow clearly defined at the sides and front of the glabella.

Fixed cheeks about one-third the width of the glabella, convex, rising from the dorsal furrow and curving over to the facial sutures and the furrows separating them from the palpebral lobes; palpebral lobes narrow, slightly elevated, and about one-third the length of the head; ocular ridges indicated more by the depressions in front of them than by their elevation above the general surface of the fixed cheeks; postero-lateral limb short, and marked by a broad, shallow furrow within the strong, rounded posterior rim; frontal limb convex, inflated at the center so as to form an elongate swelling somewhat similar to that of *Agraulos(?) melie* (p. 581); the line of demarcation between the fixed cheeks and the frontal limb is rather indefinite, the fixed cheeks merging into the downward sloping surface of the frontal limb; there is no line of demarcation to indicate a distinct frontal rim.

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 49.

<sup>b</sup> Idem, p. 47.

<sup>c</sup> China, Richthofen, IV, 1883, p. 15.

Surface smooth to the unaided eye, and under a strong lens slightly roughened with what appear to be irregular, inosculating, very slightly elevated lines, and a few low, scattered tubercles. The type and largest specimen of the head has a length of 9 mm.

*Observations.*—This species at first suggests *Agraulos*(?) *melie* (p. 581) owing to the swelling on the frontal limb, the glabella, however, is much broader in proportion to its length, and its furrows are those of *Ptychoparia* rather than *Agraulos*.

*Formation and locality.*—Middle Cambrian, lower portion of oolitic limestone series; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

**PTYCHOPARIA LILIA, new species.**

This species is represented by a single fragment of a head, preserving the glabella, the left fixed cheek, and the frontal limb and rim. It is characterized by the convex glabella, marked by three short, very slightly indicated pairs of glabellar furrows, and the strong, rounded frontal rim separated from the glabella by a very short frontal limb.

The fixed cheeks are moderately convex and marked by faint, obliquely transverse ocular ridges; palpebral lobes unknown; frontal limb narrow, slightly convex; frontal rim strong, rounded, thickened in front, and separated from the frontal limb by a shallow, narrow furrow.

Surface formed by a network of fine, irregular, inosculating, very slightly elevated lines. This surface, when partially worn, has a punctate appearance owing to the shallow places between the lines. The type and only specimen of the head has a length of 5 mm.

The associated free cheeks have a strong, rather broad border that is continued posteriorly as a strong and rather long spine.

*Observations.*—This species differs from *Ptychoparia* (*Liostracus*) *toxæus* Walcott<sup>a</sup> in having a broader, stronger frontal rim, and shorter frontal limb.

*Formation and locality.*—Middle Cambrian, Ki-chóu limestone, in brown gray, partly oolitic bed, 10 feet above red shales, supposed to correspond to the Man-t'ò shales of the Shan-tung sections; 4.5 miles south of Wu-t'ai-hiën, Shan-si, China.

Collected by Eliot Blackwelder.

**PTYCHOPARIA NEREIS, new species.**

This form is represented by several heads, exclusive of the free cheeks. Glabella and fixed cheeks are moderately convex; glabella prominent, truncato-conical, converging very gently from the base to the slightly rounded front; surface marked by three pairs of short, very slightly impressed furrows, and a very obscure, longitudinal

<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 83.

median ridge; occipital furrow shallow but clearly defined; occipital ring nearly flat, sloping from the shallow furrow slightly upward to the posterior margin, it narrows at the sides to two-thirds of its width at the center; dorsal furrow narrow, shallow, and clearly defined at the sides of the glabella, in front it is little more than the angle formed by the union of the glabella and frontal limb.

Fixed cheeks narrow, about one-third the width of the glabella, slightly convex opposite the palpebral lobes, and merging into the frontal limb in front of the ocular ridges, and sloping more gently backward to the posterior furrow; palpebral lobes narrow, about one-third the length of the head, and separated from the fixed cheeks by shallow furrows; postero-lateral limb short, and marked by a rather broad, shallow posterior furrow within a very narrow posterior margin; frontal limb short, sloping down to the very narrow, slightly defined furrow that separates it from the nearly flat, narrow frontal rim.

Surface slightly roughened, but from its condition it is impossible to state whether it is like the surface of *Ptychoparia lilia* (p. 588). The largest head in the collection has a length of 3.5 mm.

*Observations.*—The subrectangular glabella is somewhat like that of *Ptychoparia aelis* Walcott,<sup>a</sup> but the short frontal limb and flat rim distinguish it from the latter species.

It is associated with *Ptychoparia vesta* (p. 590), from which it differs in the form of the glabella and palpebral lobes.

A form closely related to this occurs about 100 feet lower at the same locality and section.

*Formation and locality.*—Middle Cambrian, lower portion of oolitic limestone series; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

**PTYCHOPARIA UNDATA, new species.**

This species is represented by four specimens of the central portions of the head, exclusive of the free cheeks. These show that the head was semicircular in outline and rather strongly convex. Glabella convex, irregularly subquadrangular in outline, it narrows slightly from the base toward the front; the postero-lateral angles are rounded, and the anterior angles more broadly rounded into the slightly curved front; three pairs of glabellar furrows are indicated by slight depressions that extend in from the margin about one-half the distance to the median line; the posterior pair extends obliquely backward so as to indicate oval postero-lateral lobes; occipital ring rounded and strongly defined, narrow at the sides, gradually widening toward the center, which is slightly above the plane of the surface of the glabella; occipital furrow narrow, rounded, distinct, and curving slightly for-

<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 75.

ward toward the center; dorsal furrow rather sharply defined at the sides and shallow in front of the glabella.

Fixed cheek narrow, and elevated into a ridge opposite the palpebral lobe, which is separated by a narrow, curved furrow; ocular ridge low, narrow, and passing obliquely from the anterior end of the palpebral lobe to the antero-lateral angle of the glabella; postero-lateral limb narrow, about as long as the width of the front of the glabella, and marked by a rather strong furrow within an elevated, narrow posterior rim; frontal limb narrow, merging in front into the narrow, slight furrow produced by the union of the frontal limb and frontal rim; frontal rim of medium width, moderately convex, and rounding down to meet the frontal limb.

Surface appears to be minutely and irregularly punctate under a lens of moderate power. Under a strong lens it is shown to be formed by a network of irregularly inosculating, raised lines, that are so interrupted in places as to give a granular appearance to the surface. The largest head in the collection has a length of 5 mm.

*Observations.*—This species is most nearly related to *Ptychoparia comus* (p. 586); it differs in having a proportionately shorter glabella, and a more convex, thickened frontal rim. It differs from *Ptychoparia* (*Liostracus*) *thraso* Walcott<sup>a</sup> in its shorter frontal limb and proportionally longer glabella.

This species is associated with *Ptychoparia comus* and *Solenopleura pauperata* (p. 593).

*Formation and locality.*—Middle Cambrian, oolitic limestone; 4 miles south-southwest of Tung-yü-chön, Shen-si, China.

Collected by Eliot Blackwelder.

#### PTYCHOPARIA VESTA, new species.

Of this species the central portions of the head are known, and associated free cheeks and pygidia. The parts of the head preserved show it to have been moderately convex, and semicircular in outline. Glabella convex, not very prominent, broadly truncato-conical in outline; antero-lateral angles rounded, front gently curved; between the base and front the sides are slightly incurved at a point about two-thirds the distance from the base to the front; three pairs of glabellar furrows that extend about one-half the distance from the sides toward the center are faintly impressed; occipital furrow narrow, shallow, and transverse; occipital ring narrow at the sides, widening toward the center where the surface is on the plane of the glabella; dorsal furrow narrow and clearly defined at the sides, and shallow in front of the glabella.

Fixed cheeks a little more than one-half the width of the glabella, nearly flat opposite the palpebral lobes, curving gently downward pos-

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 85.

teriorly to the posterior furrow, and rather abruptly downward to merge into the frontal limb; palpebral lobes a little less than one-half the length of the head, narrow, and separated from the fixed cheeks by rather strong, curved furrows; ocular ridge low, rather strong, and extending obliquely forward from the anterior edge of the palpebral lobe to the side of the glabella, just back of its antero-lateral angle; frontal limb short, gently convex, and sloping down from the front of the glabella to the rounded furrow formed by its merging with the frontal rim; frontal rim nearly flat and rising at a low angle from the furrow.

Surface smooth to the unaided eye, finely punctate under a strong lens. The largest head referred to this species has a length of 9 mm., and the specimen selected as the type, a length of 4 mm., with a width at the outer edge of the palpebral lobes of 6 mm.

The associated free cheek has the same type of nearly flat rim as the rim in front of the glabella; this is extended at the postero-lateral angle into a moderately strong, sharp spine; the body of the cheek rises to the base of the eye lobe with very little convexity; it is separated from the lateral and posterior borders by a shallow furrow; the surface is marked by irregular lines radiating from the base of the eye lobe toward the furrow within the outer margin.

The associated pygidium has a planulate border that merges into the slope of the pleural lobes; axis convex, about three-fourths the length of the pygidium, and marked by three shallow transverse furrows that are continued across the pleural lobes out onto the planulate margin.

*Observations.*—The general form of the head of this species is much like that of *Ptychoparia impar* Walcott.<sup>a</sup> It differs in having a flatter frontal rim, less convex frontal limb, stronger glabellar furrows, and larger palpebral lobes. From *Ptychoparia (Liostracus) megalurus* Dames<sup>b</sup> it differs by having a more subquadrangular glabella, and larger palpebral lobes.

*Formation and locality.*—Middle Cambrian, lower portion of oolitic limestone series; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

#### PTYCHOPARIA, species undetermined.

This form is represented by a minute head 1.25 mm. in length. It has an elongate glabella of the type of *Ptychoparia theano* Walcott,<sup>c</sup> but its palpebral lobes are longer than in that species. It may be the young of *Ptychoparia aelis* Walcott.<sup>d</sup>

A small head about 2 mm. in length of about the same character as

<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 78.

<sup>b</sup>*Liostracus megalurus* Dames, 1883, China, Richthofen, IV, p. 20.

<sup>c</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 82.

<sup>d</sup>Idem, p. 75.

the one mentioned above, but differing from it in having a shorter frontal limb, occurs in the upper portion of the Ki-chóu limestone, 4 miles east of Fang-lan-chón, Shan-si, China. The locality of the head first described is as follows:

*Formation and locality.*—Middle Cambrian, in a brown, oolitic limestone near the base of the Ki-chóu formation; 4 miles south southwest of Tung-yü-chón, Shen-si, China.

Collected by Eliot Blackwelder.

**PTYCHOPARIA(?) MAIA, new species.**

This species is represented by one fairly good specimen of the central portions of the head, to which the description of *Ptychoparia?* *bromus* Walcott<sup>a</sup> applies, with the exception that the latter has broader fixed cheeks and a flatter frontal rim. *P. (?) maia* also has short, strong ocular ridges that are not present in *P. ? bromus*.

The type specimen of the head has a length of 4.25 mm.

*Formation and locality.*—Middle Cambrian, in a brown, oolitic limestone near the base of the Ki-chóu formation; 4 miles south-southwest of Tung-yü-chón, Shen-si, China.

Collected by Eliot Blackwelder.

**LIOSTRACUS Angelin, subgenus of PTYCHOPARIA.**

**PTYCHOPARIA (LIOSTRACUS) INTERMEDIA, new species.**

This is a form intermediate between *Ptychoparia tolus* Walcott<sup>b</sup> and *Ptychoparia (Liostracus) subrugosa* (p. 592). It is represented by the well preserved central portions of the head of a single specimen. It differs from both of the species mentioned by having a proportionally shorter, broader glabella, with a strong, uniform dorsal furrow about it, and two pairs of less strongly indicated glabellar furrows; also in the details of the frontal limb and rim.

The surface of *Ptychoparia (L.) intermedia* is marked by a few scattered, rather large tubercles and many very fine tubercles. A head 8 mm. in length has a width at the outer edge of the palpebral lobes of 9 mm., with a convexity of 2 mm. above the plane of the margin of the head.

*Formation and locality.*—Middle Cambrian, upper part of oolitic formation; Ch'au-mi-tien, Shan-tung, China.

Collected by Eliot Blackwelder.

**PTYCHOPARIA (LIOSTRACUS) SUBRUGOSA, new species.**

This species is represented by two specimens of the head, exclusive of the free cheeks. These portions of the head are subrectangular

<sup>a</sup>Proc. U. S. Nat. Mus., XXIX, 1905, p. 76.

<sup>b</sup>Idem, p. 82.

in outline, strongly convex. Glabella prominent, strongly convex, with its sides converging from a width of 6.5 mm. at the base to 4 mm. at the front, in a glabella 6.5 mm. long, exclusive of the occipital furrow and ring; front arched, with a shallow pit in the dorsal furrow where the sides and front unite; the glabella is marked by three pairs of shallow, rather broad glabellar furrows, the posterior pair of which extends obliquely inward and backward about one-third the distance across the glabella; occipital furrow rounded and rather deep; occipital ring narrow and moderately convex at the sides, gradually increasing in convexity and width toward the center, where a small node occurs; dorsal furrow strong at the sides and in front of the glabella.

Fixed cheeks about half as wide as the glabella at its base, convex at the center, and sloping gently backward to the posterior furrow and more abruptly downward to the frontal limb; palpebral lobes central and small; ocular ridge rather strong, rounded, and extending from the anterior rim of the palpebral lobe obliquely forward across the fixed cheek to a point just back of the pit at the antero-lateral angle of the glabella; frontal limb of medium width, slightly convex, and passing into the rounded furrow within the rounded, strong, convex frontal rim.

Surface with prominent, fine granulations over the glabella and fixed cheeks, with the exception of the smooth places indicating the glabellar furrows. A head 10.5 mm. in length has a width of 14 mm. at the palpebral lobes.

*Observations.*—In form this species is closely related to *Ptychoparia* (*Liostracus*) *thraso* Walcott.<sup>a</sup> It differs in having a more convex fixed cheek and frontal rim, and in having a granulated instead of a smooth surface. From *Ptychoparia tolus* Walcott<sup>b</sup> it differs in having a proportionally more conical glabella, stronger frontal rim, and finer granulose surface.

*Formation and locality.*—Middle Cambrian, base of Ch'ang-hia oolite; 2.2 miles southwest of Yen-chuang, Sin-t'ai District, and in upper part of oolitic formation at Ch'au-mi-tien, Shan-tung, China.

Collected by Eliot Blackwelder.

#### Genus SOLENOPLEURA Angelin.

#### SOLENOPLEURA PAUPERATA, new species.

This species is represented by the central portions of the head, exclusive of the free cheeks and the occipital ring. The portions preserved show that the head was semicircular, and rather strongly convex. Glabella truncato-conical, rounded in front, strongly convex, and marked by three pairs of very short, slightly impressed furrows; the fragment of the occipital furrow remaining shows it to have been

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 85.

<sup>b</sup> Idem, p. 82.

narrow and rather deep; occipital ring unknown; dorsal furrow narrow and rather deep at the sides, and clearly defined in front of the glabella.

Fixed cheeks about two-thirds the width of the glabella, convex, and curving gently to the front and back; palpebral lobes central and small; no traces of ocular ridges; postero-lateral limb about as long as the width of the glabella, and marked by a sharply impressed furrow within a narrow, rounded posterior rim; the line of demarcation between the front of the glabella and the frontal rim is a rather deep, narrow furrow, no traces of a frontal limb being present; frontal rim strong, rounded, and broadly curved in front.

Surface minutely granular, with a few larger granules scattered over the surface of the glabella, and a number of slightly larger granules scattered over the surface of the fixed cheeks. The type and only specimen of the head has a length of 3 mm., exclusive of the occipital ring.

*Observations.*—This species is characterized by the absence of a frontal limb, and its broadly conical glabella, in these respects differing from *Solenopleura agno* Walcott<sup>a</sup> and *S. beroe* Walcott.<sup>b</sup> It also differs from the two mentioned species by having a more finely granulated surface.

*Formation and locality.*—Middle Cambrian; 4 miles south-southwest of Tung-yü-chön, Shen-si, China.

Collected by Eliot Blackwelder.

#### Genus DOLICHOMETOPUS Angelin.

##### DOLICHOMETOPUS HYRIE, new species.

This species is represented by a single specimen of the central portions of the head, and an associated free cheek and pygidium. Glabella moderately convex, with the sides slightly converging toward the broadly rounded front; glabellar furrows faintly impressed; the posterior pair extends obliquely inward and backward, obscurely outlining a subtriangular lobe on each side; also two pairs of short, faintly impressed furrows that extend in at nearly right angles to the sides of the glabella; occipital furrow shallow, somewhat deeper at the sides than in the center; occipital ring narrow at the sides, widening gradually toward the center where it is of medium width, slightly convex, and rising but little above the general surface of the glabella; dorsal furrow shallow, indicated by the union of the sloping sides and front of the glabella with the fixed cheeks and frontal limb.

Fixed cheeks narrow, nearly flat opposite the palpebral lobes, and sloping gently to the front and back; what is preserved of the palpebral lobes indicates that they were elongate, extending about one-third or more of the length of the head; a narrow, slightly elevated ocular

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 89.

<sup>b</sup> Idem, p. 91.

ridge extends obliquely across the narrow fixed cheek; frontal rim short and nearly flat; the curved angle at the union of the fixed cheeks and glabella gives the impression that the frontal rim is slightly concave.

Associated free cheek subtriangular, with a long genal spine.

Surface, as seen by a strong lens, slightly roughened with minute granules. The type and only specimen in the collection has a length of 7.5 mm.

The associated pygidium is transverse, semicircular, and convex; axial lobe convex, a little more than three-fourths the length of the pygidium, and crossed by three rather clearly defined, narrow furrows, that differentiate three rings and a terminal portion; the outline of the axis is continued by a low swelling that extends from the end of the convex axis to the posterior margin; the furrows crossing the axis curve outward and slightly backward across the pleural lobes to the margin of the border; they are broader than the furrows on the axis and separate three rather clearly defined segments from a narrow frontal rim and a posterior portion back of the axis; border relatively narrow, and sloping gently from the base of the pleural lobe to the outer margin; it arches slightly inward back of the axis. The largest specimen has a width of 26 mm., with a length of 14 mm. A small specimen 15 mm. in width has a less clearly defined border, and in other respects resembles the pygidium associated with *D. deoia* Walcott.<sup>a</sup>

*Observations.*—This species differs from *D. alceste* Walcott<sup>a</sup> in having a proportionately longer frontal rim, less distinctly defined glabellar furrows, and in being less convex. From other described species of the Chinese Cambrian it differs in having a glabella that narrows toward the front instead of expanding. The associated pygidium is much like that associated with *D. deoia* Walcott.<sup>a</sup> It differs in having a narrower, more clearly defined border, and more clearly defined furrows upon the pleural lobes.

*Formation and locality.*—Middle Cambrian, lower portion of oolitic limestone series; 4 miles east of Fang-lan-chön, Shan-si, China.

Collected by Eliot Blackwelder.

<sup>a</sup> Proc. U. S. Nat. Mus., XXIX, 1905, p. 94.



# DESCRIPTIONS OF THREE NEW SPECIES OF KATYDIDS AND A NEW GENUS OF CRICKETS FROM COSTA RICA.

By JAMES A. G. REHN,

*Of the Academy of Natural Sciences of Philadelphia.*

The following new forms are contained in the collection of the U. S. National Museum, and form part of the Schild and Burgdorf collection of Costa Rican insects. The author wishes to thank the officials of the United States National Museum for the opportunity to study this and other material from the collections under their charge.

## **TURPILIA GRANDIS**, new species.

*Type*.—Female; San Carlos, Costa Rica. (Schild and Burgdorf.)  
[Cat. No. 9477, U.S.N.M.]

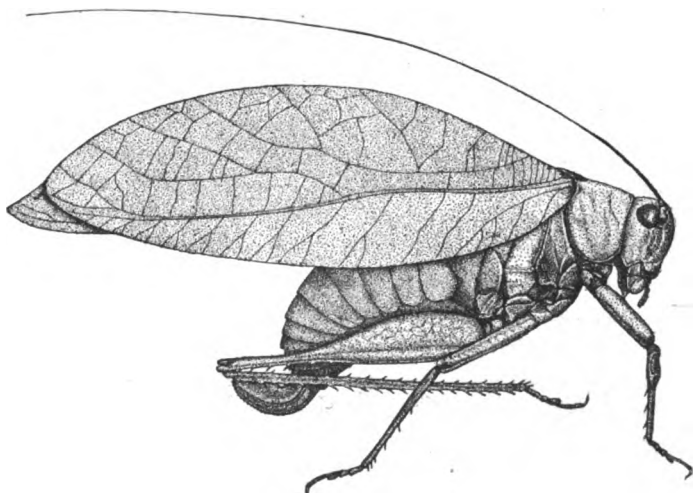


FIG. 1.—*TURPILIA GRANDIS*. LATERAL VIEW OF TYPE. ( $\times 2$ .)

Related to *T. obtusangula* Brunner, but differing in the longer and much broader tegmina, the more curved ovipositor, and the shorter caudal femora. In general appearance it closely resembles *T. punctata* Stål of the West Indies, but that species has the metasternal lobes more produced and the ovipositor much larger.

Size rather large; form strongly compressed. Head with the occiput very slightly rounded; fastigium very narrow, compressed, very narrowly sulcate except at the apex, margins raised, thickened, and

diverging caudad; frontal fastigium narrowly in contact with the fastigium of the vertex; eyes globose, moderately prominent; infraocular region with a flattened, rugulose impressed area, longer than broad, but of indefinite shape; antennæ in length about equal to the head, pronotum and tegmina together, first and second joints rather large, remainder slender and filiform, scrobes large and extending almost to the level of the ventral portion of the eyes. Pronotum deplanate dorsad, lateral angles distinct but rounded cephalad, caudal half of the dorsum with a slightly depressed reniform shagreened area; cephalic margin arcuato-emarginate, caudal margin arcuate with a very slight median emargination; lateral lobes deeper than long, the margins

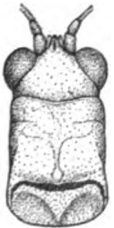


FIG. 2.—*TURPILIA GRANDIS*. DORSAL VIEW OF HEAD AND PRONOTUM. ( $\times 3$ .)

rounded and with a distinct but rather shallow humeral sinus. Tegmina elongate-ovate, the greatest width being contained three times in the length, cephalic and caudal margins arcuate, the latter slightly more than the former, apex narrowly rounded; mediastine vein but faintly indicated proximad, median vein with its forks reaching the caudal margin. Wings moderately slender, the greatest width distinctly less than half the length. Prosternum unarmed. Mesosternum with distinct triangular lobes, the caudal margin with an obtuse-angulate emargination. Metasternum with the caudal margin subtruncate, the lobes subrotundate laterad. Ovipositor

small, broad, bent proximad, straight distad, apex acute, the margins serrate, the dorsal serrato-dentate. Cephalic femora armed ventrad with three spines on the cephalic margin; median femora armed on the same margin with three to five spines. Cephalic tibiæ slender except for the inflation over the auditory foramina, rounded, slightly depressed dorsad, but without distinct sulcation; foramina elongate reniform. Caudal femora not exceeding the body in length, moderately inflated in the proximal half, the inflation principally dorsad of the median line, distal portion slender, subequal; tibiæ distinctly exceeding the femora in length.

General color apparently apple-green, now present only on a few small areas, the remainder faded to dull greenish white. Cephalic and lateral margins of the reniform marking on the pronotum, and a short arcuate line at the base of the dorsal field of the tegmina, blackish, the pronotal maculation generally dull olive-green.

*Measurements.*

|                               | mm.  |
|-------------------------------|------|
| Length of body.....           | 24.0 |
| Length of pronotum.....       | 5.5  |
| Length of tegmen.....         | 37.5 |
| Greatest width of tegmen..... | 12.5 |
| Length of caudal femur.....   | 18.2 |
| Length of ovipositor.....     | 6.0  |

The type only has been examined.

## ISCHNOMELA PULCHRIPENNIS, new species.

*Type*.—Male; Carrillo, Costa Rica. (Schild and Burgdorf.) [Cat. No. 9479, U.S.N.M.]

Allied to *I. gracilis*, but differing in the shorter tegmina and caudal femora.

Size medium; form moderately elongate; surface glabrous. Head with the occiput very broadly arcuate; fastigium compressed, knife-like, of moderate elevation, the paired ocelli at the base and separated by a very slight space, apex very obliquely truncate, ventrad touching the facial fastigium; facial fastigium moderately produced, the apex blunt, ventrad occupied almost wholly by the median ocellus; eyes reniform, about equal to the infra-ocular space in length; palpi with the penultimate joint short, hardly half the length of the terminal, compressed, except for a rounded proximal section, antepenultimate joint slightly shorter than the terminal joint subcylindrical, terminal joint slightly curved, slightly larger distad than proximad, tip slightly excavate; antennae very slender filiform, elongate, about three and one-half times the length of the body, proximal and second joint large. Pronotum subsellate, the prozona distinctly arcuate dorsad, the metazona slightly but distinctly deplanate; cephalic margin very slightly arcuate,

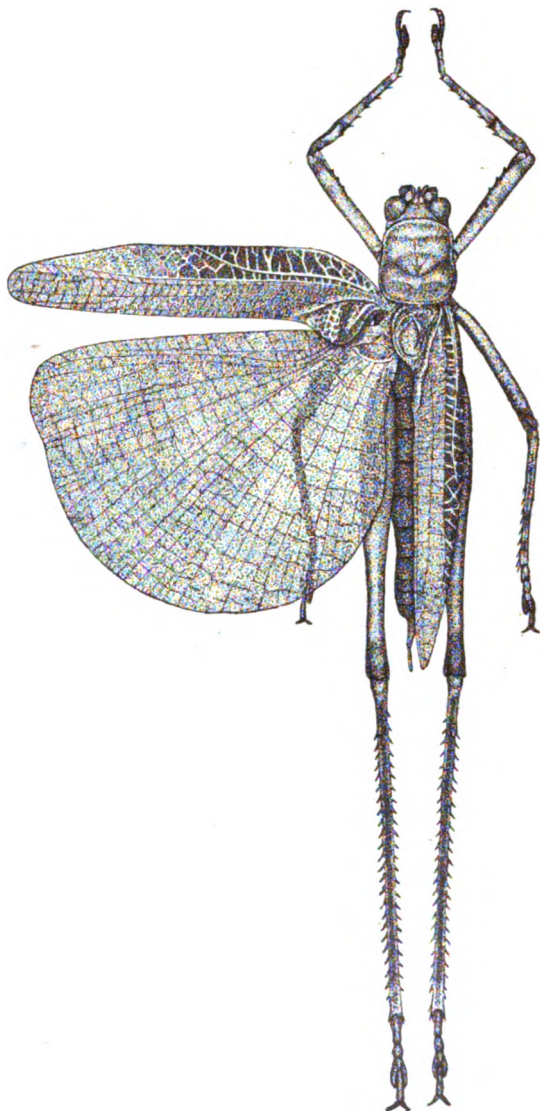


FIG. 3.—ISCHNOMELA PULCHRIPENNIS. DORSAL VIEW OF TYPE (ANTENNAE OMITTED). ( $\times 14$ .)

caudal margin truncato-arcuate; prozona about twice the length of the metazona, the cephalic and caudal transverse sulci distinctly and the median slightly impressed, metazona with at least the caudal half impresso-punctate; lateral lobes longer than deep, the ventral margin slightly sinuate, caudal margin rounded with the sinus slightly marked, a slight but apparent shoulder developed on the metazona. Prosternum with a pair of elongate slender spines. Tegmina exceeding the body and about reaching the tips of the caudal femora, sublanceolate with the apex rounded, the greatest width being contained about four and a half times in the length; cephalic margin very slightly arcuate, the caudal margin straight; mediastine and anterior radial veins with numerous oblique rather regular branches extending to the cephalic margin; ulnar veins extending parallel to the caudal margin; veins of the marginal field and the network of the

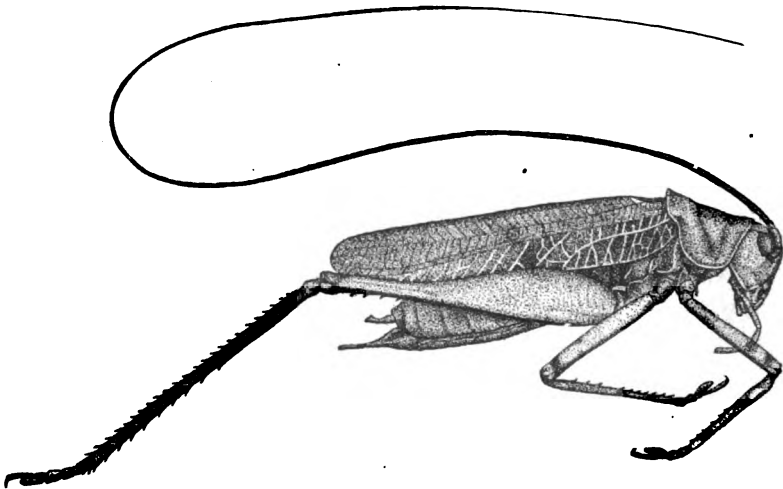


FIG. 4.—*ISCHNOMELA PULCHRIPENNIS*. LATERAL VIEW OF TYPE. ( $\times 14$ .)

tambourine of the right tegmen coriaceous. Wings slightly longer than the greater width, the margin regularly rounded. Terminal abdominal segment with a median truncate emargination; supra-anal plate produced, trigonal, longitudinally depressed mesad; cerci straight, except for an apical internal deflection, which is depressed into a lamellate ridge on the internal side and supplied with three distinct teeth; subgenital plate produced, carinate ventrad, the apical margin with a very deep median V-shaped emargination, styles slightly longer than the depth of the median emargination. Cephalic femora half again as long as the pronotum, very slightly larger distad than proximad; cephalic tibiae about equal to the femora in length, moderately inflated at the slits of the bullae. Median femora slightly longer than the cephalic, subequal in circumference except for the slightly con-

stricted apex; tibiae equal in length. Caudal femora distinctly shorter than the length of the tegmina, the proximal five-eighths being strongly bullate, the inflation being almost wholly dorsal, the ventral margin with five spines in the apical half; caudal tibiae slightly longer than the femora, all margins spined, the dorsal about twice as heavily armed as the ventral, the spines on the latter face adpressed.

General color tawny-olive, with a touch of ferruginous on the pronotum and cephalic limbs. Antennae washed with ferruginous; eyes drab. Tegmina with the marginal field blackish proximad fading to the general tint distad, the veins Naples yellow, and strongly contrasted with the base color; anal field of the right tegmen saffron yellow, with the file marked with an arcuate transverse bar of brownish black. Wings dilute wood brown, a slightly marked yellowish suffusion proximad. Abdomen mummy brown, touched with blackish distad. Femora all striped ventrad with blackish; cephalic with two distal annuli, one distinct, the other faint; median marked as the cephalic; caudal without annuli. Cephalic and median tibiae with several more or less distinct incomplete annuli; caudal tibiae tawny-olive, the spines darker. Tarsi blackish ventrad.

*Measurements.*

|                                | mm.  |
|--------------------------------|------|
| Length of body.....            | 37.5 |
| Length of pronotum .....       | 7.2  |
| Length of tegmen .....         | 32.2 |
| Greatest width of tegmen ..... | 6.7  |
| Length of caudal femur.....    | 27.5 |

The type is unique.

**MIMETICA CRENULATA**, new species.

*Type*.—Male; Turrialba, Costa Rica. (Schild and Burgdorf.) [Cat. No. 9478, U.S.N.M.]

This species is apparently allied to *M. brunneri* Saussure and Pictet, but can be readily separated by the crenulato-lobate distal third of the caudal margin of the tegmina, the blunter apex of the same, and the more deeply rounded and sharply defined emarginations of the cephalic margin. As the males of several species of the genus are unknown, this may possibly represent the opposite sex of a species already known. However, none of the species known only from the female approach this form in the character of the tegmina except *M. subintegra* Saussure and Pictet, which is a much larger insect with a somewhat different venation.

Size, medium; form compressed, as is usual in the genus; surface, tuberculato-rugose. Head distinctly flattened cephalad; vertex horizontal; fastigium but little produced, rectangulate, longitudinally sulcate; facial fastigium acute; antennae heavy, margin of the scrobes touching on the dorsal half of the internal margins, the fastigium of the

vertex and the facial fastigium separated by the structure of the scrobes, first and second joints large, the proximal larger, the joints of the remainder of the antennæ imperfectly marked; eyes ovoid, rather small. Pronotum sellate, depressed dorsad, the caudal section produced and expanded, surface tuberculate; cephalic margin truncate, caudal margin

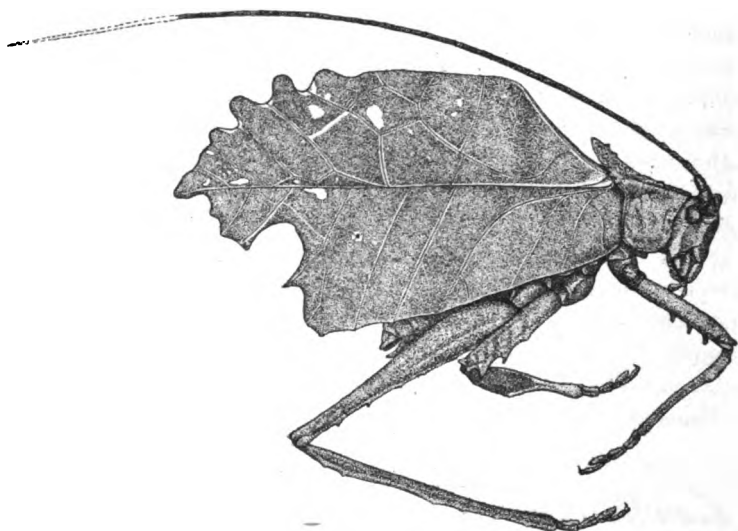


FIG. 5.—*MIMETICA CRENULATA*. LATERAL VIEW OF TYPE. ( $\times 2$ .)

arcuate with a rounded median emargination; lateral lobes rounded, about as long as deep, sinus very slight, a distinct overhanging shoulder present. Tegmina of the peculiar "dried-leaf" type found in all the species of the genus, and of a form defying description, the figure representing the characters satisfactorily; the regularly rounded dentate character of the distal half of the caudal margin and the position of the large rounded emargination of the cephalic margin are the principal characters. Wings considerably longer than broad. Abdomen compressed, each of the segments with a median acute lobule on the dorsal margin; terminal dorsal segment roundly emarginate; supra-anal plate broader than long, the apical margin truncate; cerci broad, flat, acute, not exceeding the supra-anal plate in length; subgenital plate subquadrate, the caudal margin truncate. Cephalic femora about as long as the pronotum, the ventro-cephalic margin with four dentiform lobes, the proximal quite small, cephalic genicular lobes



FIG. 6.—*MIMETICA CRENULATA*. DORSAL VIEW OF PRONOTUM OF TYPE. ( $\times 3$ .)

acute; cephalic tibiae slightly longer than the femora, expanded and inflated at the bullæ, the distal portion slender. Median femora about equal to the cephalic in length, armed with three similar lobes, the proximal quite small, increasing in size distad, genicular lobes equal in size and moderately acute; median tibiae very slightly longer than the

femora, inflated, strongly compressed in the proximal half with the entire margins acute and slightly elevated. Caudal femora nearly two and a half times the length of the pronotum, heavy, the proximal half moderately inflated, the inflation being dorsal, and the ventral margin nearly straight, with several short, spiniform lobes and a number of blunt spines; caudal tibiae slightly longer than the femora, slightly sinuate, the dorsal margin distinctly sinuate with several blunt spined tubercles on each margin.

General color very dull, obscure, olive-green, the veins of the tegmina gamboge yellow. Limbs speckled and washed with ochraceous-rufous, the median tibiae with the inflation uniform ochraceous-rufous. Abdomen pale apple-green, the margins regularly spotted with ochraceous-rufous. Wings cream buff-hyaline.

*Measurements.*

|                               | mm.  |
|-------------------------------|------|
| Length of body.....           | 20.0 |
| Length of pronotum.....       | 7.2  |
| Length of tegmen.....         | 28.0 |
| Greatest width of tegmen..... | 17.5 |
| Length of caudal femur.....   | 18.2 |

The type is the only specimen seen by the author.

**SYMPHYLOXIPHUS**,<sup>a</sup> new genus.

Allied to *Anaxipha* Saussure and *Falcicula* Rehn,<sup>b</sup> but differing from both in the arched corneous tegmina with poorly defined veins; also from *Anaxipha* in the shape and unarmed edges of the ovipositor, and from *Falcicula* in the slenderer body and limbs and the presence of distinct tympani on the cephalic tibiae.

This genus and species bears a wonderful resemblance to *Phylloscrytus brunnerianus* Saussure, from which it can be readily separated by the nonfoliaceous palpi, the heavy depressed proximal antennal joint and a number of their characters.

*Type of the genus.*—*Symphyloriphus magnificum*.

**SYMPHYLOXIPHUS MAGNIFICUM**, new species.

*Type.*—Female; Carrillo, Costa Rica (Schild and Burgdorf). [Cat. No. 9480, U.S.N.M.]

Size very small; form much as in *Falcicula*; surface of the body, except the pronotum, glabrous. Head with the occiput rounded, declivent cephalad; fastigium rather narrow, somewhat compressed; eyes large, prominent, occupying the greater part of the depth of the head, subovoid in outline; antennae with the proximal joint strongly depressed, second joint small, cylindrical, remaining joints very short and smaller than the second joint, but similar in character; palpi with

<sup>a</sup> Συμφυλος kindred, ξιφος *saber*.

<sup>b</sup> Entom. News, XIV, p. 258.

the ultimate joint tubiform, the apex obliquely and sharply trimmed, penultimate joint about half the length of the ultimate, antepenultimate joint longer than the penultimate and shorter than the ultimate.

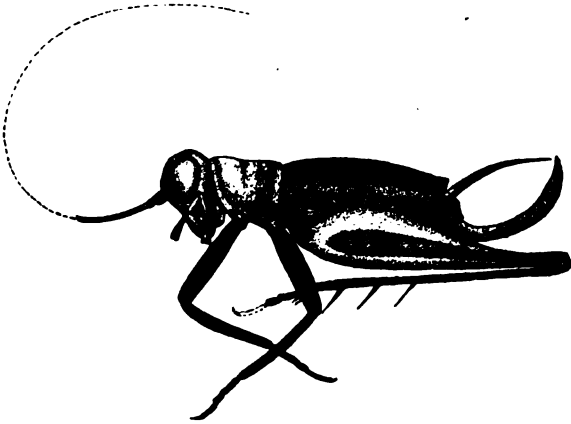


FIG. 7.—*SYMPHYLOXIPHUS MAGNIFICUM*. LATERAL VIEW OF TYPE. ( $\times 7$ .)

Pronotum well haired; margins subtruncate, the dorsum arched transversely; lateral lobes longer than deep, the ventro-cephalic angle rounded, the ventro-caudal angle distinct. Tegmina corneous, distinctly glabrous, the angle of the dorsal and lateral fields moderately marked; veins poorly defined and longitudinal in disposition, with

very few distinct branches; distal margin with a distinct emargination slightly mesad of the vein dividing the two fields. Cerci about two-thirds the length of the tegmina, tapering; ovipositor reaching to the tips of the cerci, evenly and moderately arcuate, apex acute, the dorsal margin with a very slight preapical emargination, margins unarmed; subgenital plate moderately produced, the apex narrowly and triangularly emarginate. Cephalic tibiae with a distinct linear longitudinal imperforate tympanum. Median limbs, particularly the tibiae, slenderer than the cephalic. Caudal femora strongly inflated proximad, tapering evenly to the slender tips; caudal tibiae very slender, slightly longer than the femora, supplied with three pairs of spurs, very long and spiniform.

General colors orange-rufous and shining black. Head orange-rufous with several obscure brownish maculations; eyes isabella-color; antennae with the proximal and second joints black, the remainder buff; palpi buff except the terminal

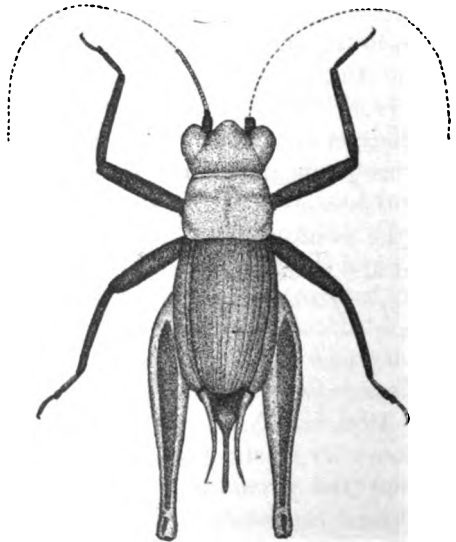


FIG. 8.—*SYMPHYLOXIPHUS MAGNIFICUM*. DORSAL VIEW OF TYPE. ( $\times 7$ .)

joint, which is black. Pronotum orange-rufous. Abdomen and tegmina shining black; ovipositor ferruginous, the distal half darker than the proximal; cerci buff, the tips darker. Cephalic and median limbs black, except the proximal half of the metatarsi, which is buffy. Caudal femora buff with a broad subfusiform bar of black on the lateral face; caudal tibiæ blackish, the spurs and tarsi buffy, the spurs with dark tips.

*Measurements.*

|                              | <i>mm.</i> |
|------------------------------|------------|
| Length of body.....          | 5.1        |
| Length of pronotum.....      | 1.1        |
| Length of tegmen.....        | 3.1        |
| Length of caudal femora..... | 5.0        |
| Length of ovipositor.....    | 2.1        |

The type is unique.



# NOTES ON SOME RECENT ADDITIONS TO THE EXHIBITION SERIES OF VERTEBRATE FOSSILS.

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By CHARLES W. GILMORE,  
*Of the Department of Geology.*

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## INTRODUCTION.

The purpose of these brief notes is to call attention to some of the more important accessions recently placed on exhibition in the court devoted to Vertebrate Paleontology in the U. S. National Museum.

### A SKELETON OF RHAMPHORHYNCHUS GEMMINGI Meyer.

One of the specimens secured especially for the Museum exhibit at the Louisiana Purchase Exposition was a well-preserved example (No. 2420)<sup>a</sup> of that curious flying reptile, *Rhamphorhynchus gemmingi*, from the lithographic limestone quarries (Upper Jurassic), near Eichstatt, Germany.

This is one of the few specimens in which the impressions of the wing membrane have been preserved. The wing in form somewhat resembled that of the bat, but the membrane was attached only to the fifth or little finger, which had an enormous development. A critical examination of the obverse and reverse slabs (Plates XXX and XXXI) shows the linear depressions along the wing bones produced by the folding of the membrane. The impression of the rhomboidal flap of membrane, which probably acted in the capacity of rudder when in flight, may be seen at the distal extremity of the tail. This specimen, when entombed in the rocks, had the wings folded, but an example of *R. phyllurus* in the Yale University museum and several specimens in the Bayet Collection, now belonging to the Carnegie Museum, Pittsburg, Pennsylvania, show by the impressions that the wings were somewhat extended. One at least in the latter collection has the wings fully open.

Most of the bones are pneumatic—that is, hollow and filled with air, after the manner of birds. The eyes are protected by a ring of sclerotic plates (see Plate XXX), somewhat similar to those found around

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<sup>a</sup> Catalogue number of the U. S. National Museum.

the eyes of the Ichthyosaurs. The teeth are small, few in number and very sharp. All of the American forms are supposed to be edentulous.

The remains of these reptiles occur in Europe and North America in rocks of Jurassic and Cretaceous age. Pteranodon and allied forms are particularly abundant in the Niobrara chalk of Kansas.

*Measurements.*

|                                  | Inches. |
|----------------------------------|---------|
| Length of skull .....            | 41      |
| Length of tail .....             | 134     |
| Length of fifth digit .....      | 184     |
| Estimated expanse of wings ..... | 40      |

**SKULL OF TRICERATOPS CALICORNIS Marsh.**

In the series of Ceratopsia remains preserved in the National Museum is a considerable part of a skeleton, the type of *Triceratops calicornis* (No. 4928).<sup>a</sup> This species was described<sup>b</sup> by Prof. O. C. Marsh just prior to the removal of that part of the fossil vertebrate collection belonging to the U. S. Geological Survey from New Haven to Washington, and was based upon certain peculiarities observed in the nasal horn-core.

Plate XXXII shows the skull and prementary of this animal as it is now exhibited. This specimen Sk. 29<sup>c</sup> 2171<sup>d</sup> was collected by the late Mr. J. B. Hatcher from the Cretaceous (Laramie), on Lance Creek, Converse County, Wyoming, in 1891.

With the exception of the left parietal (of which only a small portion remains) this side of the skull is very complete. The frill and jugal region of the opposite side are wanting. The other parts of the skeleton preserved are a portion of the atlas, 11 presacral vertebrae, part of the sacrum, portions of both ilia, 2 pubes, quite complete, several cervical and thoracic ribs, and numerous fragments of the skull and other body elements, including many short pieces of the ossified tendons, so common along the backbone of Trachodon. In cleaning the sacrum of No. 4928 ossified tendons were found embedded in the matrix, situated, as they must have been in life, in the muscles along the back on either side of the spinous processes of the vertebrae. This is the first time these tendons have been found so far posteriorly in a member of the Ceratopsia, although their presence there had been suspected.

<sup>a</sup> Catalogue number of the U. S. National Museum.

<sup>b</sup> American Journal of Science, (4), VI, p. 92.

<sup>c</sup> Hatcher's original field number.

<sup>d</sup> Marsh's number.

Sk. 29 is the largest of the *Triceratops* skulls preserved in the collection of this museum. The principal dimensions are as follows:

Greatest length from front of beak to back of parietal, 6 feet 5 inches.

Greatest length from front of beak to end of occipital condyle, about 4 feet.

Height of post-orbital horn-core, 30 inches.

Anterior-posterior diameter of same horn-core at base, 12 inches.

#### SKULL OF *DICERATOPS HATCHERI* Lull.<sup>a</sup>

Plates XXXIII and XXXIV illustrate the front and side views of the skull of a new member of the *Ceratopsia* recently described<sup>b</sup> by Mr. J. B. Hatcher as pertaining to a distinct genus and species.

The type, No. 2412<sup>c</sup> (originally designated by the field number as Sk. 25), was collected about 3 miles southwest of the mouth of Lightning Creek, Converse County, Wyoming, by Messrs. Hatcher and Utterback, in 1891.

The skull is all that is known of this animal, and when found was inclosed in a hard sandstone concretion. According to Hatcher, this concretion "had entirely weathered out of the surrounding sandstone and stood at an altitude of 5 or 6 feet above the ground, firmly attached beneath to another concretion. The skull stood on its nose, with the frill pointing upward."

The tips of the horn-cores and the crest of the parietals had been eroded away. These portions (see Plate XXXIII) have been restored in plaster, but otherwise the skull is very complete and but little distorted for a fossil of such robust proportions.

The absence of a nasal horn-core and the presence of large fenestræ on either side of the frill (see Plate XXXIII) in the squamosals constitute the essential characters upon which this genus is based.

Doctor Lull, in a note following the description of this form, makes the suggestion that the openings in the squamosals may possibly be pathologic. While it is true that the two apertures are not symmetrical, the pathologic character of the anterior border of the larger opening would, to my mind, account for the asymmetry of the two fenestræ. A comparison of Hatcher's drawing of the dorsal view (Plate XIII, fig. 2<sup>b</sup>) with the photograph of the anterior view (see Plate XXXIII of this paper) shows at once that the right opening has been incorrectly placed in the drawing. It will also be noticed that these

<sup>a</sup> In editing Mr. Hatcher's Monograph on the *Ceratopsia*, Dr. R. S. Lull found in the manuscript a description of this specimen, to which, however, no name had been assigned. Doctor Lull has given it the very appropriate title of *Diceratops hatcheri*, the generic name being suggested by the lack of the nasal horn, while the specific name serves "to commemorate Mr. Hatcher's work in connection with this remarkable type."

<sup>b</sup> American Journal of Science, XX, Dec., 1905, pp. 413-419, pl. XIII.

<sup>c</sup> Catalogue number of the U. S. National Museum.

fenestræ (except in size, as explained above) are quite symmetrically placed, the distance from the lateral border being practically the same on either side. Although these openings occur on the unprotected border of the frill, it would be a remarkable coincidence for the animal to have been wounded in such an identical manner on both sides and in the places where the bone is heaviest.

The skull, as exhibited, was prepared by the writer:

*Principal measurements.*—Greatest length, 6 feet 1 inch; greatest breadth, 4 feet 2 inches.

#### A MOUNTED SKELETON OF MASTODON.

Of all the extinct animals none is found more widely distributed geographically, and probably few are better known to the layman, than the mastodon. It appears to be the popular belief that the mastodon was a very much larger animal than the elephant of to-day, but in reality it did not exceed the Indian elephant in size, though proportionately lower and more heavily built. The largest males rarely reached a height of 10 feet and the females were much smaller.

The mastodon skeleton (No. 2106)<sup>a</sup> recently placed on exhibition (Plate XXXV) in the U. S. National Museum is a well-preserved specimen of an adult female, which has been identified by Mr. F. A. Lucas as pertaining to the species *Mammot americanum*.

The specimen was found in 1901 by Mr. Levi Wood in a peat swamp on his farm near Church, Michigan.

After exhuming a few of the best preserved bones, the right to disinter the remainder of the skeleton was purchased by the Museum authorities, and Mr. Alban Stewart was detailed to complete the excavating as well as to prepare the specimen for shipment to Washington.

It was found that, although the skeleton lay on its left side and apparently in good position for the preservation of all its parts, all of the leg bones were missing, except those of the right fore limb. The specimen is one of the many curious examples of the lack of important bones that one would naturally expect to be present, while other bones that might have been lost were preserved.

The skeleton was embedded in peat a few feet below the surface and immediately above an 18-inch stratum of blue clay.

The bones recovered consist of a skull and lower jaws, 1 tusk partially complete and the basal portion of the other, 7 cervicals, 17 dorsals, 3 lumbaris, sacrum, 11 caudals, 30 ribs, a portion of the sternum, pelvis very complete, the right fore limb, and numerous foot bones.

The skeleton was first mounted by Mr. Alban Stewart, under the direction of Mr. Lucas, and was included as a portion of the National

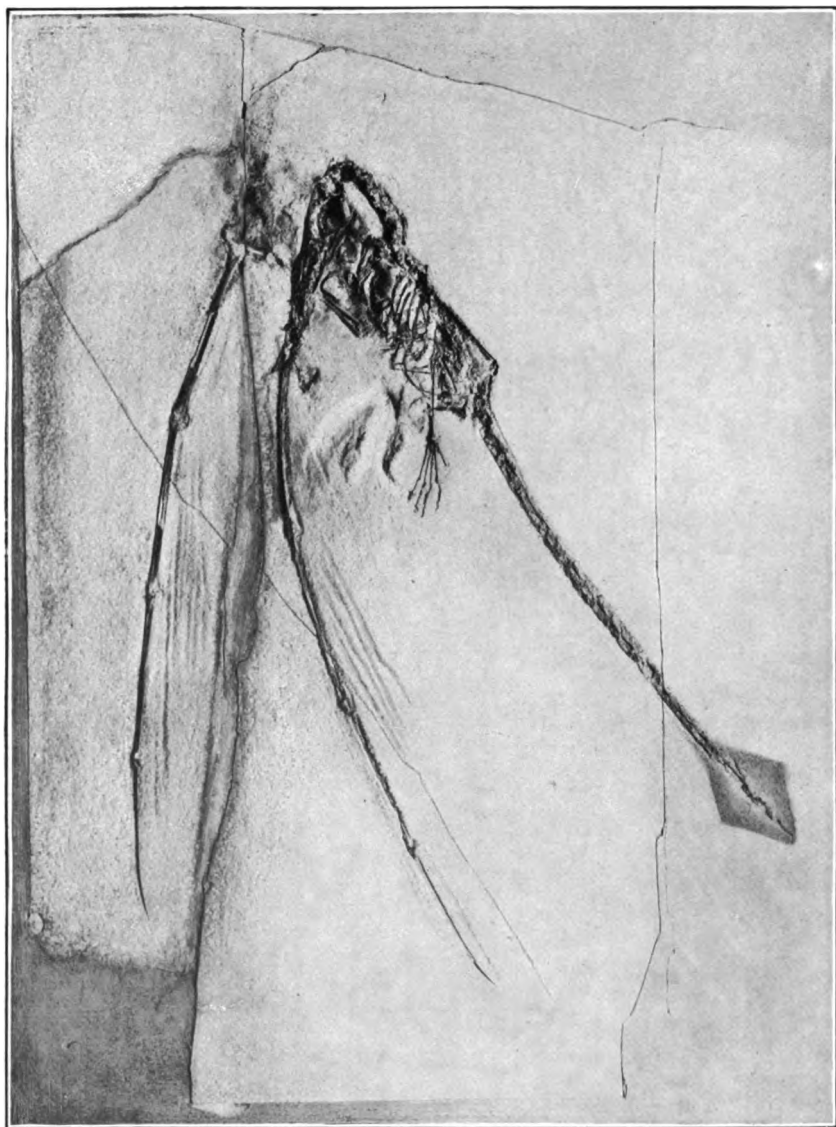
<sup>a</sup> Catalogue number of U. S. National Museum.

Museum exhibit at the Louisiana Purchase Exposition at St. Louis, Missouri, in 1904.

The missing parts were restored in plaster, with the exception of the left hind limb (No. 4980), which belongs to an individual of about the same size and proportions from Kimmswick, Missouri. The restored parts are colored to resemble the bone, although the shade differs sufficiently to be readily distinguished.

The skeleton at the highest point is about 7 feet 7 inches above the base and is 14 feet from the tip of the tusks to the tail.

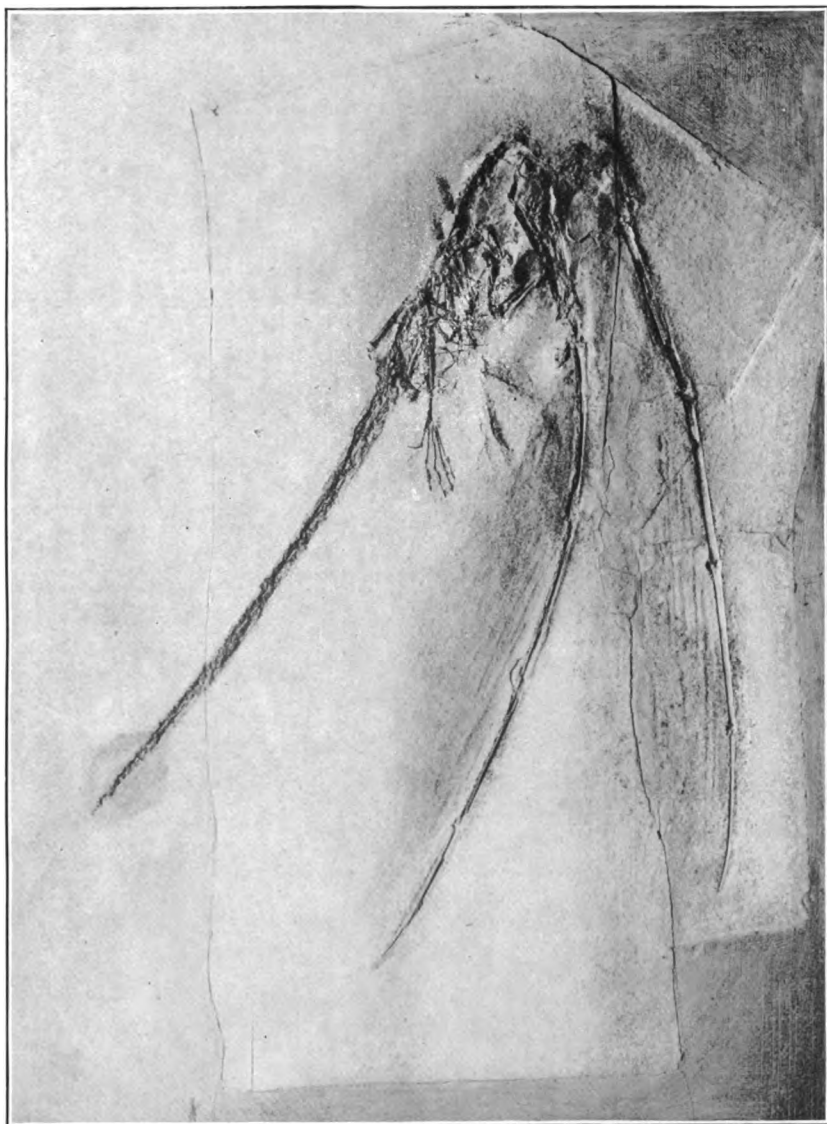




**SKELETON OF RHAMPHORHYNCHUS GEMMINGI.**

FOR EXPLANATION OF PLATE SEE PAGE 607.

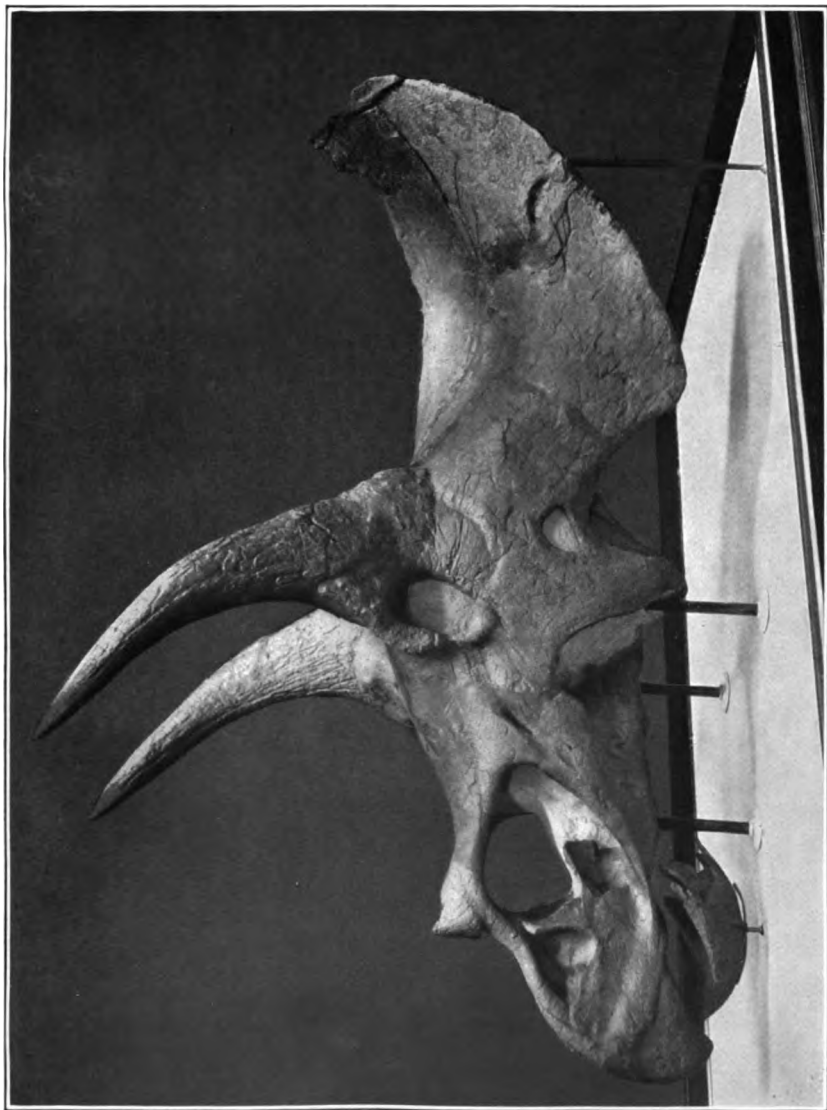




SKELETON OF RHAMPHORHYNCHUS GEMMINGI.

FOR EXPLANATION OF PLATE SEE PAGE 607.

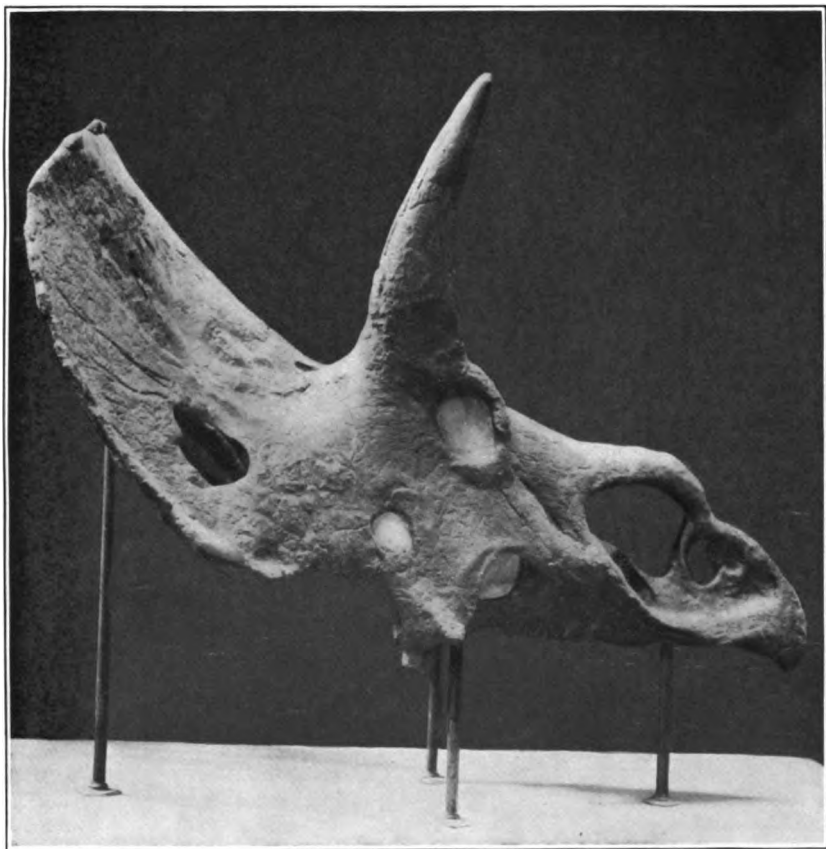




LATERAL VIEW OF THE SKULL OF *TRICERATOPS CALICORNIS*.

FOR EXPLANATION OF PLATE SEE PAGE 608.

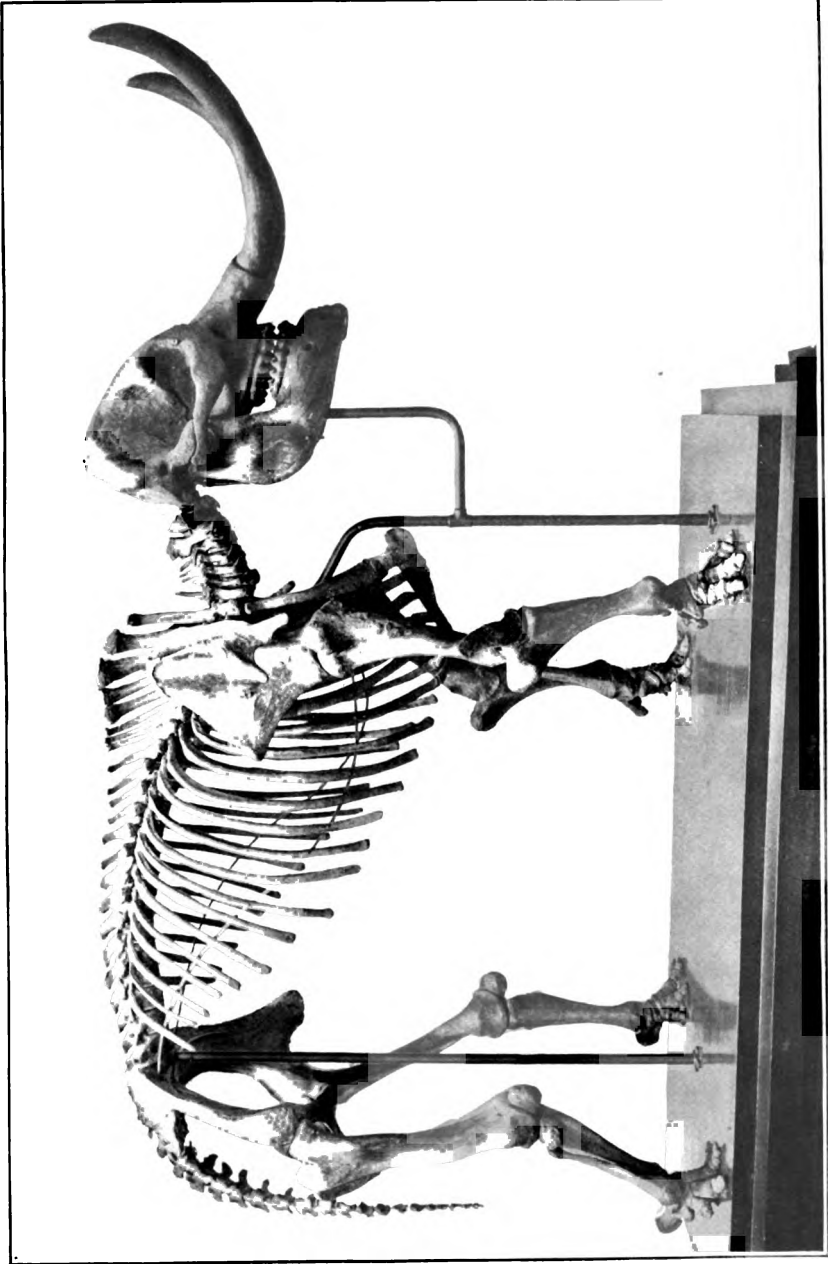




LATERAL VIEW OF THE SKULL OF DICERATOPS HATCHERI.

FOR EXPLANATION OF PLATE SEE PAGE 609.





**MOUNTED SKELETON OF MASTODON.**  
FOR EXPLANATION OF PLATE SEE PAGE 610.



# SYNOPTIC LIST OF PARAGUAYAN ACRIDIDÆ, OR LOCUSTS, WITH DESCRIPTIONS OF NEW FORMS.

By LAWRENCE BRUNER,  
of the University of Nebraska.

The present paper is based primarily on the extensive collection obtained from Mr. W. T. Foster, of Sapucay, Paraguay, and now belonging to the United States National Museum. In addition, the writer has personally collected in that country, besides having purchased several small collections from that section of South America.

To make the paper as complete as possible, Giglio-Tos's papers have been consulted, and all the forms not represented in the collections studied have been included.

## TABLE FOR DETERMINING THE SUBFAMILIES OF PARAGUAYAN LOCUSTS.

- a. Claws of feet without a cushion or arolium between them; pronotum extending over the abdomen; tegmina or front wings lobiform ..... TETTIGINÆ
- aa. Claws with the cushion or arolium present; pronotum not extending over the abdomen.
  - b. Antennæ, or feelers, shorter than the front femora, or thighs.
    - c. Head short, compressed in front ..... EUMASTACINÆ
    - cc. Head greatly elongated, body apterous or subapterous ..... PROSCOPINÆ
  - bb. Antennæ as long or longer than the front femora.
    - c. Prosternum, or breast, between base of front pair of legs smooth; not provided with a tubercle, swelling, or spine.
      - d. Fastigium of the vertex but little declivous, meeting the face in a more or less well-defined angle, the face usually very oblique. Wings, as a rule, without a dusky band ..... TRUXALINÆ
      - dd. Fastigium of the vertex rounded at its point of junction with face, the latter vertical or nearly so. Wings when present usually with colored disk and well-defined dusky band ..... CEDIPODINÆ
    - cc. Prosternum, or breast, between base of front pair of legs laminately elevated in front, tuberculate or spined.
      - d. Foveolæ of the vertex above, contiguous, forming the apex of the fastigium. Rather clumsy insects, usually without or with abbreviated wings, but occasionally with these appendages complete ..... PYRGOMORPHINÆ
      - dd. Foveolæ of the vertex lateral, never forming the apex of the vertex, often closed behind or entirely wanting. Prosternum distinctly spined or tuberculate. Wings variously formed ..... ACRIDINÆ

## Subfamily TETTIGINÆ.

The grouse locusts are especially numerous in the Tropics, but on account of their small size and inconspicuous colors are rarely collected except by specialists. A few are at hand and others have been reported upon as coming from Paraguay. The two forms herewith described as new are characterized by Dr. J. L. Hancock, to whom they were submitted for study.

## TABLE FOR DETERMINATION OF GENERA.

- a. Front thighs more or less carinated above; front margin of pronotum in middle not advanced upon the back of head.
  - b. Body, even of the female, quite slender, the apex of pronotum greatly extended beyond the tip of hind femora.....*Nephele* Bolivar
  - bb. Body in both sexes obese, the apex of pronotum not at all or but little extended beyond the tip of hind femor.....*Apotettix* Hancock, *Paratettix* Bolivar
- aa. Front thighs not compressed, rather broadly and distinctly grooved; front margin of pronotum in middle angulate or more or less advanced upon the occiput.
  - b. Vertex in front terminating in oblique carinæ; frontal costa rather broadly sulcate.....*Tettigidea* Scudder
  - bb. Vertex in front not carinate; frontal costa very narrowly sulcate.  
*Batrachidea* Serville

## NEPHELE Bolivar.

## NEPHELE ASMODÆUS (Serville).

*Tettix asmodæus* SERVILLE, Hist. Nat. Orthopt., 1839, p. 760.

*Nephele asmodæus* BOLIVAR, Essai Tettigidæ, 1887, p. 79.

*Habitat*.—This insect is credited to Asuncion, Paraguay, by Bolivar.<sup>a</sup>

## NEPHELE GRACILIS Bruner.

This insect, according to Doctor Hancock, belongs to the genus *Paratettix* and comes near to *P. caudatus* (Saussure). It occurs at Asuncion.

## APOTETTIX Hancock.

The representatives of this genus fall between *Tettix* and *Paratettix*. They differ chiefly in the structure of the vertex and in having the first joint of the hind tarsi decidedly longer than the third. The following description was drawn up by Dr. J. L. Hancock, to whom the species is to be credited:

## APOTETTIX BRUNERI, new species (Hancock).

*Characters*.—Male, body scabrus subtuberculate; moderately robust; ferrugineous, with the tibiæ more or less lightly bianulate with fuscous, tarsal apices of the same color. Head well crowded under the pronotum to the eyes, not at all elevated or exserted. Vertex short, nearly twice the breadth of one of the eyes; median carina distinct, little

<sup>a</sup>Boll. Mus. Zool. Anat. Torino, XV, 1900, No. 377, p. 3.

elevated anteriorly and produced; on either side between the eyes shallowly fossulate, but only lowering the vertex very little below the level of the eyes. Eyes small and globose. Frontal costa widely sulcate, the rami evenly divergent forward to the median ocellus, convexly produced between the antennæ. Pronotum anteriorly truncate, posteriorly subulate, extending backward beyond the hind femora a distance equal to about half their length; dorsum rugose-scabrus, subtuberculose, rather wide between the shoulders, lightly convex, and behind the shoulders little flattened; humeral angles distinct, widely angulate and carinate; anterior carinæ abbreviated being barely shorter than the eyes; median carina of pronotum percurrent, in front of the shoulders arcuate subdepressed; the posterior angles of the lateral lobes very little angulato-laminate outward, and obliquely truncate behind; elytral and posterior sinuses nearly equal in depth. Elytra oval; wings caudate, passing the pronotal process. Anterior femora compressed, the superior carinæ convex, the lower margin undulate; breadth of middle femora equal to about one-half that of its length, carinæ strongly compresso-carinate, above and below little lobate; posterior femora stout, the margins arcuate, minutely serrulate; posterior tibiæ plurispinose, canthi minutely serrulate; the first article of the posterior tarsi distinctly longer than the third, the first two pulvilli equal in length and acute, the third little longer and flat below. Total length of body 10.2 mm.; pronotum 8.5 mm.; posterior femora 4.5 mm.

*Type*.—Cat. No. 9754, U.S.N.M.

*Habitat*.—Paraguay, January 25, 1901.

This species is distinguished from the other members of *Apotettix* by the broader vertex, the more scabrus dorsum and the subproduced obliquely truncated posterior angles of the lateral lobes of pronotum.

#### PARATETTIX Bolivar.

##### PARATETTIX SCHOCHII Bolivar.

*Paratettix schochii* BOLIVAR, Essai Tettigidae, 1887, p. 100.

This insect is credited to Asuncion, Paraguay, by Giglio-Tos. It is quite possible, however, that this is an error and another insect is referred to.

##### PARATETTIX BORELLII Giglio-Tos.

*Paratettix borellii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 28.

*Paratettix toltecus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 5.

*Habitat*.—Very common throughout middle Argentina and northward. Quite likely also occurs in Paraguay, though no specimens are at hand from that country.

**PARATETTIX CNEMIDOTUS (Burmeister).**

*Tetrix cnemidota* BURMEISTER, Handb. Ent., II, 1838, p. 659.

*Paratettix cnemidotus* BOLIVAR, Essai Tettigidae, 1887, p. 100.

*Habitat.*—This Brazilian insect, so thinks Giglio-Tos, has been taken in the Province of Jujuy, Argentina. It no doubt occurs as well in Paraguay, since most of the representatives of this subfamily enjoy a rather wide distribution.

**PARATETTIX CAUDATUS (Saussure).**

One female labeled simply "Paraguay," January 25, 1901, and two females and a male, from Sapucay, Paraguay. W. T. Foster, collector.

**TETTIGIDEA Scudder.****TETTIGIDEA MULTICOSTATA Bolivar.**

*Tettigidea multicostata* BOLIVAR, Essai Tettigidae, 1887, p. 125.

*Habitat.*—This species is represented by specimens coming from Sapucay, where they were taken by W. T. Foster. It is also known to occur quite commonly throughout northern Argentina and southern Brazil (Bolivar, Giglio-Tos).

**TETTIGIDEA GRACILIS Bruner.**

*Tettigidea gracilis* BRUNER, Locusts of Argentina, 1900, p. 17.

*Habitat.*—A single specimen, the type, of this insect is at hand. It was taken on the steamer near the borders of Paraguay by the writer. It is evidently a native of that country as well.

**BATRACHIDEA Serville.****BATRACHIDEA FLAVONOTATA Bolivar.**

*Batrachidea flavonotata* BOLIVAR, Essai Tettigidae, 1887, p. 126.

*Habitat.*—Asuncion, Paraguay. Possibly the same as the following species, described by Hancock:

**BATRACHIDEA NOTATA, new species (Hancock).**

*Characters.*—Male, body granulose, ferrugineo-fuscous, lateral lobes and lower portion of face similarly colored, legs pale. Vertex equal to one of the eyes in breadth, distinctly flattened and nearly on a level with the eyes, narrowed forward, the front margin truncate, on either side with minute abbreviated, rounded carinae, mid-carina vestigial and minutely elevated anteriorly. Eyes subglobose. Frontal costa narrowly compressed, facial contour depresso-convexed, very little produced, not at all sinuate. Pronotum anteriorly strongly spiniform produced, posteriorly the apical process abbreviated acute, not extended

backward to the knees, antero-lateral margin behind the frontal spine very shallowly convexly excavate on each side, anterior carinæ behind the front margin distinctly convergent backward, in length not quite equal to that of the eyes, median carina percurrent, substraight, little compresso-elevated, behind the spine anteriorly as far backward as the sulci distinctly compressed, and barely elevato-arcuate forward. Elytra elongate, acuminate forward, widest near the apex, and presenting a large oval pale macula, occupying about a third of the elytral area posteriorly (probably smaller in the female); wings undeveloped. Femoral margins entire, posterior femora stout, the superior margin arcuate, the antegenicular denticle acute; posterior tibiæ plurispinose, the canthi minutely serrulate and little expanded toward the apex; the first article of the posterior tarsi with the third pulvilli barely longer than the first and second and straight below.

Total length of body, 9 mm.; pronotum, 6.5 mm.; posterior femora, 5 mm.

*Type*.—Cat. No. 9755, U.S.N.M.

*Habitat*.—Sapucay, Paraguay. W. T. Foster, collector.

#### Subfamily EUMASTACINÆ.

No specimens of this group are at hand, but the following-named genera and species are known to occur in the region covered by the present paper:

#### TABLE FOR DETERMINATION OF GENERA.

- a. Fastigium of the vertex very narrow, scarcely or not at all projecting in advance of the eyes..... *Eumastax* Burr
- aa. Fastigium of the vertex wider and more or less projecting in advance of the eyes..... *Manyntes* Karsch

#### EUMASTAX Burr.

This generic name has recently been suggested by Malcolm Burr<sup>a</sup> in place of *Mastax* Perty, which had been used several years before in Coleoptera. This being the typical genus of the subfamily necessitated the changing of that name also.

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Apex of the vertex above the eyes, when viewed from the side, not visible. Tegmina and wings fully developed. Posterior femora irregularly black spotted..... *pardalina* Burr
- aa. Apex of the vertex above the eyes when viewed from the side plainly visible. Deflexed lobes of the pronotum with the anterior angle obtuse..... *versicolor* Burr

#### EUMASTAX PARDALINA Burr.

*Eumastax pardalina* BURR, Essai sur les Eumastacides, p. 51.

This insect was described as coming from Paraguay.

<sup>a</sup> Anales de la Sociedad Española de Historia Natural, XXVIII, 1899.

**EUMASTAX VERSICOLOR Burr.**

*Eumastax versicolor* BURR, Essai sur les Eumastacides, p. 54.

This is also a Paraguayan species.

**MASYNTES Karsch.****TABLE FOR DETERMINATION OF SPECIES.**

- a. Tegmina lobiform, elliptical, the apex broadly rounded. Pronotum truncate behind, the middle minutely notched ..... *borellii* Giglio-Tos  
 aa. Tegmina and wings perfectly developed. Pronotum rounded behind, the middle not notched ..... *tigris* Burr

**MASYNTES BORELLII Giglio-Tos.**

*Masyntes borellii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 17.

It has been taken at San Pedro, Paraguay.

**MASYNTES TIGRIS Burr.**

This is also recorded as coming from Paraguay.

**Subfamily PROSCOPINÆ.**

As indicated in the table for determining the subfamilies of Paraguayan locusts, it will be seen that the insects belonging to this subfamily are rather long, wingless, and resemble to a certain extent the different species of walking sticks, or stick insects. Thus far there have been reported as coming from this region but four species. A number of others should be added. They belong to the two genera that may be separated by the accompanying table.

**TABLE FOR DETERMINATION OF GENERA.**

- a. Pronotum cylindrical, not separated from the prosternum by longitudinal lines. Body comparatively heavy in the female; antennæ nearly as long or a trifle longer than the vertex ..... *Tetanorhynchus* Brunner  
 aa. Pronotum more or less flattened from above, divided from the prosternum by a longitudinal line. Body long and slender even in the female; the vertex in both sexes advanced beyond the tip of the antennæ..... *Cephalocœma* Serville

**TETANORHYNCHUS Brunner.****TABLE FOR DETERMINATION OF SPECIES.**

- a. Rostrum of the female distinctly shorter than the remainder of head, attenuated toward the apex ..... *humilis* Giglio-Tos  
 aa. Rostrum of the female distinctly longer than the remainder of head.  
 b. Rostrum with the apex strongly clavate, posterior tibiæ armed above with 14-22 spines on the inner and outer rows..... *borellii* Giglio-Tos  
 bb. Rostrum attenuate toward the apex. Posterior tibiæ armed above with 13 spines on the inner and outer rows..... *angustirostris* Brunner

**TETANORHYNCHUS HUMILIS** Giglio-Tos.

*Tetanorhynchus humilis* GIGLIO-TOS, Boll. Mus. Torino, XII, No. 302, p. 18 (1897).

*Habitat*.—San Lorenzo, Province of Jujuy, and northward and eastward. (Giglio-Tos.)

**TETANORHYNCHUS BORELLII** Giglio-Tos.

*Tetanorhynchus borellii* GIGLIO-TOS, Boll. Mus. Torino, No. 302, p. 18 (1897).

*Habitat*.—Same localities as the preceding, and likewise Bolivia. (Giglio-Tos.)

**TETANORHYNCHUS ANGUSTIROSTRIS** Brunner.

*Tetanorhynchus angustirostris* BRUNNER, Verhandl. d. k. k. Zool. bot. Ges., XXXIX, p. 107 (1890).

*Habitat*.—San José, Argentina. (Brunner.) Possibly also from Paraguay.

**CEPHALOCÆMA** Serville.**CEPHALOCÆMA COSTULATA** Burmeister.

Plate XXXVI, fig. 1.

The collection contains several specimens of both sexes of undoubted *costulata*, which were taken at Sapucay by W. T. Foster. It has also been previously reported by Brunner and Giglio-Tos as occurring in Paraguay.

**CEPHALOCÆMA CALAMUS** Burmeister?

The collection contains several specimens, both males and females, of an insect which runs to *calamus* in Brunner's synoptic table, but which are too small by about 10 mm. (female) and 30 mm. (male). An examination of their sexual appendages points to maturity. Should this insect prove to be distinct from *calamus*, the name *burmeisteri* is proposed for it. The following brief diagnosis will show wherein it differs from that species as characterized by Burmeister:

Abdomen in some specimens showing faint costæ; pronotum weakly granulose; antennæ shorter than (female) or considerably longer than (male) the rostrum; the latter about equal to, in female, or about two-thirds as long, male, as the rest of head, its apex blunt and gently depressed or curved downward. Hind femora with 13 or 14 spines in outer row.

Length of body, male 60, female 94; of head, male 8, female 16; of rostrum, male 3, female 8.5; of pronotum, male 10.5, female 17; of hind femora, male 21, female 29; of anterior femora, male 7, female 10 mm.

*Habitat*.—Sapucay, Paraguay, January to March. W. T. Foster, collector.

## CEPHALOCÆMA TERETIUSCULA Brunner.

This insect is also credited to Paraguay.<sup>a</sup>

## CEPHALOCÆMA, species.

A fourth species of this genus is represented by a single nymph which was taken by the writer during the month of September at Sa Bernardino. It is a rather robust form with short, stout legs, and in which the rostrum of the vertex is broad, sulcate, evenly tapering and longer than the rest of the head. The hind tibiæ are provided with 17 spines on the inner and 19 on the outer upper margin and below with a few minute ones on the outer edge. The pronotum and abdomen above are furnished with longitudinal costæ in the fashion of *costulata*.

Several additional species are liable to occur in Paraguay. Those the habitat of which is known and would permit of this are also included in the following synoptic table:

## TABLE FOR DETERMINATION OF SPECIES.

- a. Rostrum of the vertex scarcely as long as or but little longer than balance of head. Pronotum punctulate or smooth. Tibiæ above on both sides with not more than 16 spines.
  - b. Rostrum of the vertex much shorter than the remainder of head. Abdomen 5-ridged ..... *costulata* Burmeister and *burmeisteri* Bruner
  - bb. Rostrum of the vertex distinctly shorter than or but little longer than remainder of head. Abdomen not 5-ridged.
    - c. More robust; rostrum pyramidal, acuminate, viewed from the front narrowly lamellate. Antennæ of female greatly surpassing the rostrum. *borrellii* Giglio-Tos
    - cc. More slender; rostrum with the sides parallel.
      - d. Rostrum linear, obtuse, viewed from the front narrowly cruciform. Antennæ of female a little surpassing the rostrum .... *caizana* Giglio-Tos
      - dd. Rostrum quadrangular, obtuse, as long as (female) or longer (male) than the rest of head? ..... *calamus* Burmeister
  - aa. Rostrum much (two or more times) longer than the remainder of head.
    - b. Pronotum longer than the head.
      - c. Pronotum with the anterior margin not tuberculate.
        - d. Rostrum less than twice the length of remainder of head, moderately dilated toward the apex. .... *obtusa* Giglio-Tos
        - dd. Rostrum fully twice as long as remainder of head, strongly dilated toward the apex ..... *magna* Giglio-Tos
      - cc. Pronotum with the anterior margin bituberculate ..... *gigantea* Giglio-Tos
    - bb. Pronotum shorter than the head.
      - c. Rostrum less than four times as long as remainder of head.
        - d. Rostrum a trifle more than twice as long as remainder of head; the anterior femora about two-thirds as long as pronotum .... *teretiusscula* Brunner
        - dd. Rostrum three times as long as remainder of head; the anterior femora a trifle longer than the pronotum. .... *lancea* Burmeister
      - cc. Rostrum more than four times as long as remainder of head. *lineata* Brunner

<sup>a</sup>See Monog. Proscop., p. 32.

## Subfamily TRUXALINÆ.

The insects belonging to this subfamily are much more numerous than are those of any of the preceding subfamilies; and, in some instances, become sufficiently numerous to be classed as destructive. The genera named in the following table are known to occur in Paraguay. Two of these genera are herewith described for the first time, while a few of the species are also made known to science in this paper.

## TABLE FOR DETERMINATION OF GENERA.

- a. Foveolæ of vertex below or absent. Face usually very oblique.
  - b. Antennæ with the joints depressed, more or less ensiform.
  - c. Wings of male more or less broadly fenestrate.
    - d. Sides of the fastigium strongly rounded, the apex not acuminate. Tegmina acuminate or decidedly obliquely truncate. Posterior femora with the apical angles horizontally produced, acuminate.
    - e. Head conical, face moderately oblique. Foveolæ of the vertex indistinct, triangular.
    - f. Vertex longer than the eyes. Tegmina of male broader than the length of the pronotum. Wings of male very broadly fenestrate.
      - Hyalopteryx* Charpentier
    - ff. Vertex shorter than the eyes. Tegmina of male narrower than the length of pronotum. Wings of male less broadly fenestrate.
      - g. Tegmina obliquely truncate at apex; wings hyaline and more or less infuscated. Pronotum with the lateral carinæ continuous uninterrupted.
      - h. Larger, general color green.....*Truxalis* Linnæus
      - hh. Smaller, general color testaceous or ferruginous.....*Orphula* Stål
    - gg. Tegmina acuminate, wings tinted with dilute red. Pronotum with the lateral carinæ interrupted.....*Eutryxalis* Bruner
  - dd. Sides of the fastigium straight or but gently rounded, the apex more or less acuminate. Tegmina broadly rounded or somewhat truncate. Posterior femora with their apical angles roundly deflexed.
    - e. Fastigium of the vertex above depressed; without a longitudinal carina.
      - f. Lateral carinæ of pronotum more or less converging near the middle. The sides of pronotum compressed; tegmina and wings fully developed.
        - g. Wings tinted with yellowish-brown; the tegmina rather broad, their apex somewhat obliquely truncate.....*Parorphula* Bruner
        - gg. Wings transparent or infuscated, the tegmina narrower, their apex rounded.
          - h. Interspace between the mesosternal lobes distinctly longer than wide. Head and pronotum subequal in length. Frontal costa distinctly sulcate throughout. Front greatly oblique. Lateral carinæ of pronotum subparallel in advance of the posterior sulcus.....*Orphulina* Giglio-Tos
          - hh. Interspace between the mesosternal lobes about as wide as long. Head shorter than the pronotum. Front less strongly oblique. Frontal costa scarcely sulcate below the ocellus. Lateral carinæ of the pronotum divergent or arcuate in advance of the hind sulcus.....*Orphulella* Giglio-Tos
      - ff. Lateral carinæ of pronotum not converging near the middle. The sides of pronotum not compressed. Tegmina and wings usually more or less abbreviated.....*Dichromorpha* Morse

- ee. Fstigium of the vertex above rounded, provided with a longitudinal carina.
- f. Wings with the anterior ulnar vein branched at base. Antennæ long, clavate in the male. Wings red and black.....*Toxopterus* Bolivar
- ff. Wings with the anterior ulnar vein not branched at base. Antennæ long, not clavate in male. Wings hyaline, more or less tinted with carmine at base .....*Fenestra* Brunner
- cc. Wings of male not fenestrate, the radial veins not incrassate and constricted on apical third. Pronotum with lateral carinæ gently diverging posteriorly; and with a pair of supplemental carinæ on disk. Antennæ subensiform. Front strongly oblique .....*Simpta* Stål
- bb. Antennæ filiform. Lateral carinæ of pronotum parallel; supplemental carinæ absent.....*Amblytropidia* Stål
- aa. Foveolæ of vertex visible from above, always present. Face usually more nearly vertical than in the alternate category.
- b. Inner apical spurs of hind tibiæ subequal in length. Antennæ, at least of male, nearly or quite as long as hind femora.
- c. Wings colored. Basal joints of antennæ depressed. Lateral carinæ of pronotum converging toward the middle. Tegmina without trace of intercalary vein.....*Dichroattix* Bruner
- cc. Wings transparent. Basal joints of antennæ not depressed. Lateral carinæ of pronotum nearly parallel. Tegmina with the intercalary vein more or less plainly developed.
- d. Pronotum provided with lateral carinæ, which are interrupted in the middle. Valves of the ovipositor of normal type....*Staurorhectus* Giglio-Tos
- dd. Pronotum entirely without lateral carinæ. Valves of the ovipositor very blunt .....*Amblyscapheus*, new genus
- bb. Inner apical spurs very unequal in length. Antennæ of neither sex anywhere near as long as hind femora.
- c. Lateral foveolæ of the vertex well developed, once and a half to twice as long as broad.
- d. Lateral carinæ interrupted in the middle, strongly divergent both in front and behind. The inner claws of hind tibiæ fully twice the length of the outer one. Wings of female fully developed.....*Stirapleura* Scudder
- dd. Lateral carinæ of the pronotum not interrupted, but gently divergent in front and behind. Inner claws of hind tibiæ less than twice the length of outer. Tegmina and wings of the female abbreviated.  
*Meloscirtus*, new genus
- cc. Lateral foveolæ of vertex obscure, linear. Lateral lobes of pronotum without raised line or carina.
- d. Larger. Lateral carinæ of pronotum more or less interrupted between anterior and posterior sulci; diverging strongly anteriorly and posteriorly .....*Plectroettix* McNeill
- dd. Smaller. Lateral carinæ of pronotum but little or not at all interrupted; divergent but little .....*Euplectroettix* Bruner

#### HYALOPTERYX Charpentier.

The genus *Hyalopteryx* of which *H. rufipennis* Charpentier is the type, occurs in the southern part of tropical South America, where it is represented by several species.

The material collected by W. T. Foster, at Sapucay, contains 5 males and 10 females of this genus. Instead of agreeing with *H. rufipennis* they differ from Charpentier's description and figures in a number of

respects, and are described herewith as new. A second species or possibly the *H. interrupta* Brunner from Sao Paulo, Brazil, is also characterized in the subjoined synoptic table, as also species described by each, Malcolm Burr and Giglio-Tos.

TABLE FOR DETERMINATION OF SPECIES.

- a. Disk of hind wings red or rufous.
  - b. Tegmina of male much wider in their broadest part than the length of the pronotum; in the female acuminate.
    - c. Hind femora without lamellate prolongations at the apex above. Colored portion of wings uniform red or reddish ..... *rufipennis* Charpentier
    - cc. Hind femora provided with lamellate projections at their apex, the one on inner side more than twice as long as the outer. Colored portion of wings much darker externally so as to form a conspicuous arcuate band.
      - interrupta* Brunner ?
      - lamellipes*, new species
  - bb. Tegmina of male no wider than the length of the pronotum; in the female subacuminate ..... *specularis*, new species
- aa. Disk and anal area of hind wings subhyaline or yellow.
  - b. Larger. Wings clear yellow; the anterior field broadly dilated and fenestrate in male ..... *exaggeratus* Burr
  - bb. Smaller. Wings subhyaline; the anterior field in male but little dilated.
    - gracilis* Giglio-Tos

HYALOPTERYX RUFIPENNIS Charpentier.

*Hyalopteryx rufipennis* CHARPENTIER, Orthopt. Descr. et Depict., 1853, pl. XLVI.

Charpentier simply gives Brazil as the habitat of his species. It may also occur in Paraguay.

HYALOPTERYX INTERRUPTA Brunner? or HYALOPTERYX LAMEL-  
LIPES, new species.

There are before me as I write several specimens of a species of this genus that possess the characters given at *cc* in the synoptic table. They come from Sao Paulo, Brazil, which is in the same general region as Paraguay.

Bang Haase lists *Hyalopteryx interrupta* Brunner in one of his catalogues. I have been unable to discover the place of publication of this species, hence do not know whether it is the same as *lamellipes*. It also belongs to the same general region.

HYALOPTERYX SPECULARIS, new species.

Pale flavo-testaceous to bruneo-testaceous, the tegmina more or less strongly and regularly conspersed with fuscous. The hind wings, especially in the males, showing traces of a deeper red band beyond the middle.

Body compressed, rather slender. Head about the same length as the pronotum; the vertex gently ascending, as long as the eyes, broadly rounded in front, convex in the middle, and provided with a

prominent longitudinal carina; frontal costa prominent between the antennæ, greatly contracted above, sulcate throughout except at the narrowest place at upper end, the sides parallel to the transverse facial groove below the ocellus, below this gently and evenly divergent. Face viewed in profile gently hollow. Antennæ broadly (female) or narrowly (male) ensiform, as long as the head and pronotum combined in the male, but considerably shorter in the female. Sides of pronotum nearly parallel, provided with four or five well-defined longitudinal ridges; lateral carinæ prominent as far as the second transverse sulcus where they divide, one part continuing as the carina, while the other forms a supplementary carina near the sides of the disk and to the hind extremity; median carina strong, especially on the front lobe, cut about the middle by the last transverse sulcus; front edge straight, hind margin obtusely angulate. Tegmina extending beyond the apex of abdomen as well as the tips of hind femora in both sexes, of moderate width and bluntly acuminate in the female, in the male about as broad at their widest part as the length of the pronotum, also somewhat acuminate at apex. Wings much shorter than the tegmina, the anterior field of the male with a broadly rounded and heavy front border made up of three heavy veins separated by two series composed of numerous short transverse parallel veinlets; the speculum moderately broad and occupying about one-fourth of the entire wing, separated into sections by 8 cross-veins. Hind femora somewhat longer (male) or about reaching (female) the tip of the abdomen, their apices on each side above produced into short acute lamellæ of about equal length. Hind tibiæ provided with about 15 spines in outer row. Subgenital plate of male abdomen acute, straight, about twice as long as its basal width. Valves of ovipositor short and blunt.

General color dull testaceous, inclining to brownish, the sides of head, back of eyes, and pronotum along lateral carinæ to hind margin with a piceous or dark brown band that continues for a short distance on the basal portion of the discal field of tegmina. The latter also provided with a few small black or dark brown discal spots basally and beyond quite generally and regularly conspersed with brown; at the extreme base on the hind margin with a small triangular red patch. Wings with the anterior field testaceous and fuscous, except the speculum, which is colorless; basal half of radial field vermillion, crossed beyond by a rather broad band of claret, the apical portion and a narrow space adjoining the speculum smoky hyaline, with dusky veins; in the female the greater portion of the wing is vermillion with the principal longitudinal veins and many of the transverse veinlets of the anterior field brown or black, the apical fourth and outer part of what corresponds to the speculum in the male smoky hyaline. Face, sides of head, pronotum, pleura, and abdomen sparsely conspersed with black dots.

Length of body, male, 27, female, 37; of pronotum, male, 4.95, female, 6.75; of tegmina, male, 22.5, female, 30; of hind femora, male, 14.5, female, 19; of antennæ, male and female, 10–13 mm.

*Type*.—Cat. No. 9728, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, in December.

#### HYALOPTERYX EXAGGERATUS Burr.

*Hyalopteryx exaggeratus* BURR, Trans. Ent. Soc. Lond., 1902, Pt. 2, p. 183.

This insect comes from the adjoining parts of Brazil and Bolivia. It may be found in Paraguay as well.

#### HYALOPTERYX GRACILIS Giglio-Tos.

*Hyalopteryx gracilis* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, No. 302, XII, 1897, p. 22.

This species was described from the Bolivian Chaco which borders on Paraguay. It is therefore likely to be found in Paraguay as well.

#### TRUXALIS Linnæus.

##### TRUXALIS BREVICORNIS (Linnaeus).

*Gryllus brevicornis* LINNÆUS, Cent. Ins. Par., 1763, p. 15.

*Truxalis brevicornis* FABRICIUS, Syst. Ent., 1775, p. 279.

*Acridium ensicorneum* DE GEER, Mem. Ins., 1773, p. 449, pl. XLII, figs. 1, 2.

*Opsomala punctipennis* SERVILE, Hist. Nat. Ins. Orth., 1838, p. 590.

*Truxalis viridula* PALISOT BEAUVOIS, Ins. Afr. and Amer., 1807, p. 80, pl. III, fig. 4.

*Oxycephus burkhartianus* SAUSSURE, Rev. et Mag. Zool., 1861, p. 315.

*Truxalis adspersa* BLANCHARD, Voy. Amer. Merid., VI, Pt. 2, 1837–43, p. 216, pl. XXVII, fig. 2.

Several specimens are at hand from Asuncion where they were collected by the writer. Giglio-Tos also reports it from the same locality. There are also a number of specimens before me that were collected at Sapucay by W. T. Foster.

It is one of the most widely distributed species of American locusts, being found on both continents between the fortieth parallels of latitude.

#### EUTRYXALIS Bruner.

##### EUTRYXALIS MINOR (Giglio-Tos).

*Metalepta minor* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, No. 302, XII, 1897, p. 22.

*Eutryxalis minor* BRUNER, Locusts of Argent., 1900, p. 24.

No specimens of this insect are at hand that were taken in Paraguay, but it was collected at Asuncion and in the adjoining parts of the Bolivian chaco by Dr. A. Borelli.

## ORPHULA Stål.

## ORPHULA PAGANA Stål.

*Gomphocerus (Hyalopteryx) pagana* Stål., Freg. Eug. Resa. Ins. Orthopt., 1860, p. 339.

*Truxalis (Orphula) pagana* Stål., Recens. Orthopt., I, 1873, p. 106.

*Orphula pagana* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, No. 184, IX, 1894, p. 9.

This species is represented by a large number of specimens that were collected both by the writer and by W. T. Foster. It comes from all the localities in Paraguay, as well as from the adjoining parts of Argentina, Bolivia, and Brazil.

## PARORPHULA Bruner.

## PARORPHULA GRAMINEA Bruner.

Plate XXXVI, fig. 7.

*Parorphula graminea* BRUNER, Sec. Rept. Merch. Locust. Invest. Com. B. A., 1900, p. 25. fig. 7.

No specimens of this insect are at hand from Paraguayan localities, but it is known to have a wide distribution in Argentina immediately to the south. It is liable to be met with on pasture lands where the forests are open or missing.

## ORPHULINA Giglio-Tos.

## ORPHULINA PULCHELLA Giglio-Tos.

*Orphulina pulchella* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, No. 184, IX, 1894, p. 9.

There are several female specimens at hand that may belong here. If they do they are hardly separable from the genus *Orphulella*, except that in these specimens the space between the mesosternal lobes is plainly longer than wide, whereas in the various species of *Orphulella* it is decidedly wider than long. Since Giglio-Tos has described only the male, the following brief diagnosis of the female may be added:

Body slender, slightly compressed at thorax, the head about as broad as the front edge and about four-fifths as long as the pronotum, the face rather strongly oblique; fastigium of the vertex forming about a right angle, as in *Orphulella*. Pronotum a very little expanding on hind lobe, which is but little, if any, shorter than the anterior; lateral carinæ in front of last transverse sulcus parallel, back of it somewhat divergent. Tegmina of medium width, not provided with discal spots, extending considerably beyond the tip of the abdomen. Hind femora a trifle surpassing the abdomen.

General color above testaceous or greenish, the sides of the head, pronotum, and pleuræ fuscous, bordered along the lateral carinæ by a

line of black, sometimes lighter or darker; below this flavous. Hind femora testaceous, their outer disk more or less ferruginous or brownish; hind tibiæ testaceous, their apex infuscated. Tegmina, except on dorsal field, more or less fuscous.

Length of body, female, 20–22; of pronotum, 3.8; of tegmina, 17; of hind femora, 11.5 mm.

*Habitat*.—Sapucay, Paraguay, January to March (W. T. Foster), 3 females. Also reported by Giglio-Tos from San Pedro.

#### ORPHULELLA Giglio-Tos.

The insects which belong to this genus are all rather small and very variable in color—so much so, in fact, that without a very full series of specimens for study the student can not construct a table that will definitely separate them. There seem to be at least four, and possibly five, well-marked forms found within the territory covered by the present paper. They may be determined by the following

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Lateral carinæ of the pronotum interrupted or obsolete between the anterior and posterior sulci.
- b. Size small ..... *gracilis* Giglio-Tos
- bb. Size larger, separate sections of carinæ lunate..... *obscura*, new species
- aa. Lateral carinæ of the pronotum complete or subinterrupted. Size larger.
- b. General color testaceous or pale ferruginous. The tegmina rather evenly sprinkled with fuscous dots.
- c. Size larger (female, 18 mm.). Lateral carinæ strongly divergent posteriorly ..... *punctata* (De Geer)
- cc. Size smaller (female, 16 mm.). Lateral carinæ less strongly divergent posteriorly ..... *intricata* (Stål)
- bb. General color green. The discal field alone varied with fuscous.

*elegans* Giglio-Tos

#### ORPHULELLA GRACILIS Giglio-Tos.

*Orphulella gracilis* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, No. 184, 1894, p. 11.

*Habitat*.—Various localities in Paraguay (Giglio-Tos); San Bernardino (Bruner).

#### ORPHULELLA OBSCURA, new species.

A very dark colored and strongly hirsute insect with broadly interrupted lateral carinæ of the pronotum, and in this respect allied to *O. gracilis* Giglio-Tos. As compared with *gracilis* it is, however, much larger and more robust, and has the hind femora more than usually robust for the genus. Body compressed and deep through the middle. Head large and wide, as long as and a little broader than the front edge of pronotum; eyes, especially in the male, large and prominent; vertex fairly wide, short, the bounding walls parallel for a short distance and meeting at fastigium in an obtuse angle even in the male; frontal

costa prominent between the antennæ, narrow above, evenly broadening below and continuous to the clypeus, profoundly sulcate throughout; lateral foveolæ large, subquadrate in the male, or acutely triangular in the female. Pronotum short, broad, rather strongly constricted in the middle; lateral carinæ obliterated between the middle and anterior sulci, strong elsewhere, the anterior section arcuate and greatly oblique or divergent, the part between the middle and posterior sulci short and lunate, broadly separated from that on the posterior lobe, the latter also a little arcuate and oblique—in each case the apices of these sections are directed inward; anterior edge truncate, the posterior broadly angulate; sides higher than long, their lower edge strongly sinuate. Tegmina moderately wide, longer than the abdomen and hind femora in both sexes, their apices broadly rounded. Hind femora robust on basal two-thirds, about normal on the outer third, a little surpassing (male) or not quite reaching (female) the tip of the abdomen. Antennæ rather heavy, filiform, a little longer than the head and pronotum taken together.

General color brownish, testaceous, very heavily and profusely marked with black. Head back of eyes, a considerable portion of the occiput, sides of pronotum, pleura, hind femora, and tegmina black—these markings much more decided and extensive in the male than in the female. On the disk of the pronotum inside the lateral carinæ, a decussate pale marking, the sides of pronotum, head, and pleura also provided with several paler markings. Hind femora, as well as those of anterior and middle pairs, likewise alternately pale and dark banded. The tibiæ and tarsi annulated with dull black. Tegmina variegated with paler discal and dorsal spots. The abdomen testaceous conspersed with black or dark brown. Wings strongly fuliginous. Antennæ ferruginous at base, but becoming much darker, almost black, apically.

Length of body, male, 16; female, 21; of antennæ, male and female, 6.75; of pronotum, male, 3; female, 3.2; of tegmina, male, 14; female, 17.5; of hind femora, male, 9; female, 10 mm.

*Type*.—Cat. No. 9729, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, 1 male and 2 females, taken during the months of January and February (W. T. Foster, collector).

#### ORPHULELLA PUNCTATA (De Geer).

*Acridium punctatum* DE GEER, Mem. Ins., III, 1773, p. 503, pl. XLII, fig. 12.

*Truxalis (Orphula) punctata* STÅL, Recens. Orthopt., I, 1873, p. 106.

*Orphulella punctata* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 12.

*Habitat*.—Sapucay, Paraguay, numerous specimens (W. T. Foster); various localities in Paraguay (Giglio-Tos). It is also found throughout Brazil, the Guianas, Venezuela, some of the West Indies, and Central America.

**ORPHULELLA INTRICATA** (Stål).

*Orphula intricata* STÅL, Recens. Orthopt., I, 1873, p. 106.

*Orphulella intricata* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 12.

*Habitat*.—Several specimens of both sexes that appear to belong here were taken by the writer at Asuncion. Others are among the material collected at Sapucay by W. T. Foster.

**ORPHULELLA ELEGANS** Giglio-Tos.

*Orphulella elegans* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 12.

*Habitat*.—Province of San Pedro, Villa Rica, and Asuncion (Giglio-Tos); Asuncion (Bruner); Sapucay (W. T. Foster).

**DICHROMORPHA** Morse.**DICHROMORPHA AUSTRALIS** Bruner.

*Dichromorpha viridis* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 24; XV, 1900, No. 377, p. 3.

*Dichromorpha australis* BRUNER, Locusts of Argent., 1900, p. 29.

*Habitat*.—Several specimens, male and female, collected by W. T. Foster at Sapucay. Asuncion (Giglio-Tos, Bruner).

The present species was wrongfully included with the considerably larger and more robust North American *D. viridis* Scudder. For a rather full synonymy of this last-mentioned species see Biologia Cent. Amer., Orthopt., II, p. 86.

**TOXOPTERUS** Bolivar.**TOXOPTERUS MINIATUS** Bolivar?

*Toxopterus miniatus* BOLIVAR, Anal. Soc. Esp. Hist. Nat., XIX, 1890, p. 314.

*Habitat*.—Several specimens of the two sexes were taken by W. T. Foster at Sapucay, Paraguay.

This insect is doubtfully referred to Bolivar's species.

**FENESTRA** Brunner.

If the genus *Fenestra* occurs in Paraguay, it will be found in open country among the bunch grasses. Three species were described by the writer.<sup>a</sup> Bruner did not mention a type for the genus, so we may consider *Fenestra pulchripennis* as the type. It may occur in Paraguay, as it appears to be the more common species in Argentina.

<sup>a</sup>Locusts of Argentina, pp. 30 and 31.

## SINIPTA Stål.

## SINIPTA DALMANI Stål.

Plate XXXVI, fig. 3.

*Gomphocerus (Sinipita) dalmani* STÅL, Freg. Eug. Resa, Ins. Orthopt., 1880, p. 340.

*Sinipita dalmani* STÅL, Recens. Orthopt., I, 1873, p. 103.

*Habitat*.—The collections made by W. T. Foster at Sapucay, Paraguay, contain examples of this insect. Stål's type came from Uruguay, and numerous examples were taken by the writer in middle and northern Argentina, where it is a very common insect on the open pampas.

## AMBLYTROPIDIA Stål.

This genus contains a rather large number of species, taking the two Americas together. They are most abundant in the Tropics, however, where the species are distributed in savannas or grassy openings in the forests. The species so far recognized may be separated by the subjoined table:

## TABLE FOR DETERMINATION OF SPECIES.

- a. Median carina of vertex quite prominent. Last transverse sulcus of pronotum situated plainly behind the middle.
- b. Quite robust, for most part pale colored, the tegmina of female not or but little surpassing the tip of the abdomen. The latter concolorous above.
- c. Antennæ of female, those of the male always more elongate, a trifle longer than the head and pronotum combined. Tegmina provided with fuscous spots.
- d. Smaller. Brazil.....*ferruginosa* Stål
- dd. Larger. Central America (Guatemala). Hind tibiæ with 13 spines in outer row.....*magna* Bruner
- cc. Antennæ of female plainly shorter than the head and pronotum combined. Tegmina variable.
- d. Tegmina pale testaceous, without fuscous spots or longitudinal pale stripes.....*australis* Bruner
- dd. Tegmina mottled, or with both fuscous spots and longitudinal pale stripes. Often largely green.
- e. Smaller. Tegmina often with a sub-costal pale line, or the dorsum with lateral green stripes reaching from the eyes to middle of the tegmina. The latter as long as abdomen.....*vittata* Giglio-Tos
- ee. Larger. Tegmina without the sub-costal pale line; the dorsum either wholly green or ferruginous. Tegmina shorter than the abdomen.  
*robusta*, new species
- bb. More slender, rather dark colored. Tegmina of female always surpassing the tip of abdomen. Abdomen of male at least bright ferruginous or orange above.
- c. Color quite uniform dusky brown, the females with distinctly flecked tegmina.
- d. Hind tibiæ 12-13 spined in outer row. British Guiana and Trinidad Island.....*trinitatis* Bruner
- dd. Hind tibiæ 15-16 spined in outer row. West coast of Central Mexico.  
*elongata* Bruner

- cc. Color dark olive brown in male. Hind tibiae 11-12 spined in outer row.  
Mexico ..... *auriventris* Bruner
- aa. Median carina of vertex less prominent. Last transverse sulcus of pronotum situated about the middle.
- b. Hind tibiae provided with 15-19 spines in outer row.
- c. Rather robust. Color variable. Costa Rican..... *costaricensis* Bruner
- cc. More slender. The color more uniform. Mexico southerly.
- d. Anterior portion of disk of pronotum narrower than the hind portion; lateral carinae in males concolorous; disk and sides not decidedly infuscated ..... *mystica* Saussure
- dd. Anterior portion of disk of pronotum about equal to the width of hind portion; lateral carinae in males pale, the disk and sides infuscated.  
*ingenita* Bruner
- bb. Hind tibiae provided with but 14 spines in outer row. Eastern United States southward ..... *occidentalis* Saussure

#### AMBLYTROPIDIA FERRUGINOSA Stål.

*Amblytropidia ferruginosa* STÅL, Recens. Orthopt., I, 1873, p. 107.—BRUNER, Biol. Cent. Amer., Orthopt., II, 1904, p. 63.

*Habitat*.—According to Giglio-Tos<sup>a</sup> this species occurs in Paraguay at various localities. The collections do not contain specimens of it.

#### AMBLYTROPIDIA AUSTRALIS Bruner.

*Amblytropidia australis* BRUNER, Biol. Cent. Amer., Orthopt., II, 1904, pp. 62, 64.

*Amblytropidia ferruginosa*, GIGLIO-TOS., Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 13; XII, 1897, No. 302, p. 25.

*Habitat*.—Specimens of this insect are at hand from Asuncion (Bruner) and Sapucay (Foster). It is more common southward in Argentina and Uruguay.

#### AMBLYTROPIDIA VITTATA Giglio-Tos.

*Amblytropidia vittata* GIGLIO-TOS., Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 13.

*Habitat*.—Luque, Paraguay (Giglio-Tos); specimens are at hand from Sao Paulo, Brazil.

#### AMBLYTROPIDIA ROBUSTA, new species.

A variable insect as to general color, in which the two sexes differ greatly in size and comparative robustness. Male slender, rufo-testaceous, with fuscous knees; female robust, varying from pale testaceous to dark brown, the dorsum sometimes uniformly green, the knees concolorous.

Head of moderate size, about as wide as front edge of the pronotum, the occiput and vertex somewhat rugose, the latter short and provided with a well-defined longitudinal carina; frontal costa prominent and unusually broad, slightly expanding below and continuous to the clypeus, in the male punctate and decidedly sulcate, in the female smooth and faintly sulcate. Antennae filiform, not quite as long

<sup>a</sup> Boll. Mus. Zool. Anat. Torino.

(female), or a little longer (male) than the combined length of head and thorax. Pronotum a little expanding posteriorly, the lateral carinæ prominent, rather coarsely punctate, most profusely so on the hind lobe; transverse sulci faint, the posterior one only severing the median carina, situated plainly back of middle. Tegmina without a definite intercalary vein, a little surpassing (male) but falling considerably short of the tip of the abdomen (female). Hind femora long and robust, surpassing the abdomen in both sexes. Hind tibiæ with 13-14 spines in outer row.

General color varying from a nearly uniform pale testaceous with an olivaceous tinge on sides of pronotum and pleura in the males to a deep brown varied with green on dorsum in females. Face usually paler than other portions of head; the usual dusky band back of eyes and along the upper edge of sides of pronotum. Tegmina immaculate in the males, in the females provided with a discal row of fuscous dots, sometimes the balance of the member also more or less regularly but dimly conspersed. Sides of the three basal abdominal segments largely black in the female, pale in male. Hind femora with their inner face and lower sulcus reddish purple (female) or orange (male). Antennæ infuscated apically.

Length of body, male, 20, female, 33; of pronotum, male, 4, female, 6; of tegmina, male, 17, female, 21; of hind femora, male, 14, female, 21.5 mm.

*Type*.—Cat. No. 9717, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, W. T. Foster, collector; several specimens of both sexes.

#### DICHROATETTIX Bruner.

##### DICHROATETTIX VIRIDIFRONS Bruner?

Plate XXXVI, figs. 5, 6.

*Dichroattix viridifrons* BRUNER, Locusts of Argent., p. 33, 1900, figs. 9 and 10.

While no specimens of this species are at hand, it is barely possible that it may occur in Paraguay as well as in Argentina.

##### DICHROATETTIX BOHLSII (Giglio-Tos).

*Fenestra bohlsii* GIGLIO-TOS, Zool. Jahrb., VIII, p. 807.

*Habitat*.—Paraguay (Giglio-Tos); Sapucay, Paraguay (W. T. Foster), several specimens of both sexes.

This insect is rather larger and more robust than the preceding, from which it differs in these respects, and in having the wings less clouded on the anterior field and apical half.

#### AMBLYSCAPHEUS, new genus.

Related to *Staurorhectus* Giglio-Tos, but differing from that genus in the entire absence of lateral carinæ on the pronotum.

Head rather large, smooth, a little broader below than above, nearly as long as pronotum; the occiput gently rounded; the vertex about as wide as the shortest diameter of one of the eyes, without a longitudinal carina, and meeting in front at less than a right angle, lateral carinae fairly prominent, the surface within depressed so as to form a semicircular groove extending across the front; frontal costa prominent, a very little narrower at the ocellus than between the antennae and below, sulcate deeply throughout. Face rather strongly oblique, straight when viewed laterally, facial carinae strong, straight, greatly divergent; eyes pyriform, considerably diverging, about as long as that portion of the cheeks below them. Antennae coarsely filiform and with the basal joints a little depressed, but not enough so as to give to these members even a subensiform appearance, a little longer than the head and pronotum together. Pronotum nearly cylindrical, without lateral carinae, but with a strong, equal, median one, smooth on anterior lobe, finely and closely punctulate on posterior, the latter lobe about one-fourth shorter than the former; anterior edge broadly rounded, the hind edge obtusangulate, lower lateral edges sinuate. Tegmina membranous, of medium width, paucily veined, the apex rounded and without an intercalary vein, a little surpassing the tip of abdomen but not quite reaching the apices of hind femora. Latter long, slender on apical, rather robust on basal half; hind tibiae profusely hirsute and with 11 spines in outer row. Upper valves of ovipositor short, slender at base but broad to near apex, the tip short. Mesosternal lobes about as wide apart as the lobes themselves.

*Type of genus.*—*Amblyscapheus lineatus*.

#### AMBLYSCAPHEUS LINEATUS, new species.

A medium sized but moderately robust insect, the general color of which is bright yellow with black antennae and two prominent very dark brown or blackish stripes which extend from the fastigium, one on each side of vertex, head, pronotum, and tegmina, to apex. On the latter these dark stripes gradually widen and occupy the entire discal field and become gradually paler from base to tip. Knees of hind femora and immediate base of tibiae also black. Hind tibiae pale glaucous above and on sides, the lower edge dark lined.

Length of body, male, 26; of pronotum, 5; of antennae, 10.5; of tegmina, 19; of hind femora, 16.5 mm.

*Type.*—Cat. No. 9730, U.S.N.M.

*Habitat.*—Sapucay, 3 females, December, February, and March.

At first glance this insect reminds one very much of the male of *Staurorhectus longicornis* Giglio-Tos, but the absence of lateral pronotal carinae will at once indicate its location. The male is evidently much smaller than the female.

## STAURORHECTUS Giglio-Tos.

## STAURORHECTUS LONGICORNIS Giglio-Tos.

*Staurorhactus longicornis* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 26.

*Habitat*.—The collections made at Sapucay, Paraguay, by W. T. Foster, and sent to both the U. S. National Museum and the writer, contain a number of individuals of both sexes. It is also common in portions of Argentina and Bolivia.

## STIRAPLEURA Scudder.

Although no specimens of this genus are at hand, nor none apparently have been reported from Paraguay, it is quite possible that *Stirapleura* is represented in the country. They may be looked for on sandy open country. *Stirapleura variabilis* Bruner, from Argentina, is figured at fig. 2, on Plate XXXVI, in order that the genus may be recognized if found.

## MELOSCIRTUS, new genus.

Related to *Stenobothrus* and *Bruneria*, but differing from both of these genera in a number of respects. Rather below medium in size; in the female with abbreviated tegmina and wings. The face, occiput, the disk, and sides of pronotum and meso- and metathorax pale streaked.

*Female*.—Head moderately large, a little wider than the front edge of the pronotum. Eyes subpyriform, about as long as the cheeks below them, separated above by a space twice the width of the frontal costa between the antennæ. Fastigium rather deeply sulcate and provided with a faint median longitudinal carina, meeting in front in an obtuse angle; lateral foveolæ small, about twice as long as wide, only partially visible from above. Front viewed in profile roundly oblique; frontal costa fairly prominent, evenly divergent and continuous to the clypeus, sulcate. Antennæ filiform, a little longer than the combined length of head and pronotum. The latter short, a very little constricted at middle, broadly rounded in front, obtusangulate behind; lateral carinæ arcuate and greatly interrupted between the transverse sulci, median carina fairly prominent throughout, cut by the last transverse sulcus a little back of its middle; lateral lobes a little higher than long, the lower edge rounded and provided on each side near the hind margin with a more or less prominent, raised, pale-colored tortuous carina. Tegmina somewhat abbreviate, about half as long as the abdomen, acuminate, the costal border a little ampliate near the base, without an intercalary vein. Hind femora rather robust, their tip coincident with that of the abdomen; hind tibiæ pro-

vided with 8 spines in outer and 10 in inner row, the inner apical spurs considerably stronger than the outer ones, unequal. Interspace between mesosternal lobes fully twice as broad as long. Valves of ovipositor small, as in its allies.

*Type of genus.*—*Meloscirtus australis*.

**MELOSCIRTUS AUSTRALIS, new species.**

General color testaceous, varied above and on the sides with fuscous, black and dirty white. Head fuscous, with pale bands on occiput, front and hind borders of cheeks, the sides back of eyes, and the base of mandibles. The lines back of eyes are quite narrow and continuous with those that follow the lateral carinæ of the pronotum. The latter with the middle of disk longitudinally pale striped or wholly fuscous, the lateral lobes provided with a rather broad oblique pale band, commencing in front at the middle and directed backward and upward to the hind edge at the shoulder, lower edge broadly pale; above this fuscous with a narrow somewhat tortuous raised pale line. Pleura varied with pale and brown. Hind femora with the outer half of upper edge entirely pale, the inner half toward the base with two fuscous blotches and an infuscated preapical dash of the same color, the outer disk in the middle and the knees both internally and externally marked with fuscous. Tibiæ testaceous conspersed with fuscous. Sides of abdomen irregularly varied with brown. Length of body, female, 17; of pronotum, 3-3.1; of tegmina, 7; of hind femora, 9.35; antennæ, 7.25 mm.

*Type.*—Cat. No. 9731, U.S.N.M.

*Habitat.*—The collection made by W. T. Foster at Sapucay, Paraguay, contains two females.

**PLECTROTETRIX McNeill.**

This genus contains a number of species, the representatives of which vary much in color. At least five of the known forms occur in Paraguay.<sup>a</sup> These Paraguayan forms may be separated by the following table:

**TABLE FOR DETERMINATION OF SPECIES.**

- a. Tegmina less densely reticulate, the post-radial area provided with two rows of cells and an intercalary vein; anterior and posterior lobes of the pronotum subequal in length.....*brasiliensis* Bruner
- aa. Tegmina more densely reticulate; the post-radial area densely and irregularly reticulate and without an intercalary vein; the posterior lobe of the pronotum longer than the anterior one.
- b. Hind tibiæ provided with 9-11 spines in outer row; size moderate.
- c. Tegmina irregularly marked with rather small dark blotches. Hind tibiæ pale, with the apical third bluish.....*conspersus* Bruner
- cc. Tegmina regularly marked with large maculations. Largely green, or with the hind tibiæ and the lower sulcus of hind femora red.

<sup>a</sup>For a discussion of the generic name see Biol. Cent. Amer., p. 99.



**PLECTROTETRIX BORELLII (Giglio-Tos).**

*Scyllina borellii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 14.

*Plectrotettix borellii* BRUNER, Biol. Cent. Amer. Orthopt., II, 1904, p. 100.

*Habitat.*—The only reference to this unusually large species is that given by Giglio-Tos. It comes from Colonia Risso, Paraguay.

**EUPLECTROTETRIX Bruner.****EUPLECTROTETRIX FERRUGINEUS Bruner.**

*Euplectrotettix ferrugineus* BRUNER, Locusts of Argent., 1900, pp. 39–40.

*Habitat.*—Asuncion, (Bruner); Sapucay (W. T. Foster). This insect was fairly common on the sandy knolls about Asuncion. It also occurs in Northern Argentina on both sides of the Rio Parana. An allied species, *Eu. conspersus* Bruner, is figured herewith on Plate XXXVI, fig. 4.

## Subfamily (EDIPODINÆ.

**TRIMEROTROPIS Stål.****TRIMEROTROPIS PALLIDIPENNIS (Burmeister).**

*Edipoda pallidipennis* BURMEISTER, Handb. Ent., II, 1838, p. 641.

*Edipoda straminea* ERICHSON, in Schomb. Faun. et Flor. Brit. Guiana, p. 582.

*Trimerotropis pallidipennis* SAUSSURE, Prodr. *Ædip.*, 1884, p. 171.

*Habitat.*—In sandy and dry localities from central Mexico to middle Argentina. It may be looked for in Paraguay, and if proper locations are examined it will no doubt be found. No specimens are at hand, nor am I aware of its having been reported as occurring in that country.

**CŒLOPTERNA Stål.****CŒLOPTERNA ACUMINATA (De Geer).**

*Acridium acuminatum* DE GEER, Mém. Ins., III, 1773, p. 501, pl. XLII, fig. 10.

*Cœlopterna acuminata* STÅL, Recens. Orthopt., I, 1873, p. 145.

*Paulinia mucosa* BLANCHARD, in D'Orbigny Voy. l'Amer., Merid., VI, Pt. Ins., p. 216, pl. XXVII, fig. 6.

*Habitat.*—Giglio-Tos gives Asuncion and Colonia Risso, Paraguay, as localities where it occurs. It is also quite generally distributed over the warmer parts of South America. The variety *brevipennis* Giglio-Tos is also credited to Paraguay.

This insect was made the type of a distinct subfamily by Stål; but Brunner v. Wattenwyl in his Revision du Systeme des Orthopteres, places it along with the *Ædipodinæ*, where I am willing to let it remain at present. The insect is one that lives upon aquatic plants and often must swim, hence the peculiar development of hind tibiae and their spurs.

## Subfamily PYRGOMORPHINÆ.

The present group of locusts, like the preceding subfamily, is rather poorly represented in this moist region, where vegetation is abundant and rank. Four genera may be contained among the locust fauna of Paraguay. They may be separated as follows:

## TABLE FOR DETERMINATION OF GENERA.

- a. Body more or less graceful and cylindrical, somewhat rugose. The antennæ filiform. Pronotum feebly carinated.
  - b. Tegmina and wings perfectly developed, extending considerably beyond the tip of the abdomen in both sexes. Carinæ of hind femora smooth. Internal angles of mesosternal lobes rounded at apex ..... *Ossa* Giglio-Tos
  - bb. Tegmina and wings somewhat abbreviated. Carinæ of hind femora toothed. Internal angles of mesosternal lobes not rounded ..... *Ommexecha* Serville
- aa. Body very obese and greatly depressed; coarsely tuberculate, carinated and spined. Antennæ with the joints somewhat flattened, subensiform. Pronotal carina always more or less cristate.
  - b. Tegmina and wings present. Pronotum without the lateral toothed, leaf-like expansion; its hind border broadly angulate and adorned with five flat, tooth-like projections—the middle one furcate ..... *Spathalium* Bolivar
  - bb. Tegmina and wings wanting. Pronotum furnished at lower lateral edges with a toothed, leaf-like expansion; its hind border broadly rounded and adorned with a series of six distinct, heavy, blunt-spines..... *Græa* Philippi

## OSSA Giglio-Tos.

## TABLE FOR DETERMINATION OF SPECIES.

- a. Body covered with long white hair. Tegmina above with an orange spot at base. Eyes globose. Posterior femora moderately heavy..... *bimaculata* Giglio-Tos
- aa. Body subglabrous. Tegmina above without a basal spot. Eyes ovoid. Posterior femora somewhat slender ..... *viridis* Giglio-Tos

## OSSA BIMACULATA Giglio-Tos.

*Ossa bimaculata* GIGLIO-TOS, Boll. Mus. Zool. Anat., Torino, IX, 1894, No. 184, p. 15.

*Habitat*.—Several specimens, both sexes, from Sapucay, Paraguay (W. T. Foster). It also occurs in the northern portions of Argentina, eastern Bolivia, and southern Brazil.

## OSSA VIRIDIS Giglio-Tos.

Plate XXXVIII, fig. 5.

*Ossa viridis* GIGLIO-TOS, Boll. Mus. Zool. Anat., Torino, XII, 1897, No. 302, p. 27.

*Habitat*.—Northern Argentina and several localities in the Bolivian Chaco (Giglio-Tos). It is also very common in the Argentine Provinces of Cardoba and Santa Fe, where it is found feeding on a certain *Nycotiana* or plant of an allied genus. It most assuredly occurs also in Paraguay.

## OMMEXECHA Serville.

## TABLE FOR DETERMINATION OF SPECIES.

- a. Tegmina not reaching the apex of abdomen.  
 b. General color green; tegmina shorter. Hind femora externally smooth.  
virens Serville  
 bb. General color dull brown; tegmina longer. Hind femora externally hirsute.  
servillei Blanchard  
 aa. Tegmina reaching beyond the tip of abdomen. The genicular lobes of hind femora two-spined; tegmina acuminate ..... *macropterum* Blanchard  
 bb. The genicular lobes of hind femora smooth. Tegmina rounded at apex.  
germari Burmeister

## OMMEXECHA VIRENS Serville.

*Ommexecha virens* SERVILLE, Revue Meth., p. 95; Hist. Orthopt., 1839, p. 701.—  
 BLANCHARD, Monog. Ommex., p. 612, pl. xxii, fig. 1a, female.

*Habitat*.—Not represented in the collections. Given originally as coming from "Buenos Aires." Supposed to be a freshly molted specimen of the next species.

## OMMEXECHA SERVILLEI Blanchard.

*Ommexecha servillei* BLANCHARD, Monog. Ommex., 1836, p. 613, pl. xxii, figs. 2, male, 3, female.

*Habitat*.—Asuncion (Giglio-Tos, Bruner); San Bernardino (Bruner); Sao Paulo, Brazil.

This insect was found on sandy ground in the city of Asuncion and also along the sandy beach of a lake at San Bernardino.

## OMMEXECHA MACROPTERUM Blanchard.

*Ommexecha macropterum* BLANCHARD, Monog. Ommex., 1836, p. 610, pl. xxi, figs. 3, 4.

*Ommexecha brunneri* BOLIVAR, Monog. Pirgomor., 1884, p. 28.

*Habitat*.—If the synonymy is correct, this insect extends from Peru to Paraguay. Sapucay, Paraguay, the two sexes (W. T. Foster).

## OMMEXECHA GERMARI Burmeister.

*Ommexecha germari* BURMEISTER, Handb. Ent., II, p. 655 (1838).—BOLIVAR, Monog. Pirgomor., 1884, p. 28, fig. 1.

*Habitat*.—Villa Rica and Asuncion, Paraguay (Giglio-Tos). Not in the collections before me.

## SPATHALIUM Bolivar.

No specimens of this genus are at hand from Paraguay, but since it occurs both to the south in Argentina and to the north in Brazil some one or more of the species undoubtedly will be found in the country now under consideration. One of the Argentinian species is figured herewith, namely, *Spathalium hispidum* Bruner, Plate XXXVII, fig. 8, male, Plate XXXVIII, fig. 11 female.

## GRÆA Philippi.

This fourth genus of the subfamily is also liable to occur in Paraguayan territory. But two species are known to the writer, and both of them are found on the pampas of Argentina from Bahia Blanca to Catamarca and northward. *Græa horrida* Philippi is shown on Plate XXXVII at fig. 1.

## Subfamily ACRIDIINÆ.

This is by far the most extensive subfamily of locusts represented in the region covered by the present paper, and contains, with but two or three exceptions, all of the destructive species. The following rather long table for the separation of the genera to which these insects belong will be of some value to the reader in separating the many forms that occur in any particular region. In genera where more than one species occur there will also be found tables for the separation of the different species.

## TABLE FOR DETERMINATION OF GENERA.

- a. Posterior tibiæ provided with an apical spine above on both margins.
  - b. Fastigium of the vertex horizontally greatly produced.
    - c. Tegmina somewhat surpassing the tip of the abdomen, their apex truncate. Superior carina of the hind femora terminating at the apex in a prominent tooth ..... *Procolpia* Stål
    - cc. Tegmina considerably surpassing the tip of abdomen, their apex narrowly rounded. Superior carina of hind femora terminating in a small tooth.
      - Munatia* Stål
    - d. Crest of the pronotum serrate throughout ..... *Prionolopha* Stål
    - dd. Crest of the pronotum not serrate, or sometimes posteriorly crenulate, or sometimes cut by the transverse sulci.
      - e. Lateral carinæ of the pronotum converging toward the front.
        - f. Carinæ of the frontal costa parallel or gently diverging above the ocellus.
          - g. Tegmina and wings complete, equaling or surpassing the abdomen.
            - Tropinotus* Serville
          - gg. Tegmina and wings abbreviated ..... *Alcemenes* Stål
          - ff. Carinæ of the frontal costa diverging above the ocellus.
            - ee. Lateral carinæ of the pronotum parallel or diverging toward the front.
              - Elæochlora* Stål
    - bb. Fastigium of the vertex sloping or depressed.
      - c. Wings with that portion just back of the vein which divides the first and second parts dilated and provided with numerous parallel transverse veins.
        - d. Fastigium of the vertex subtriangularly acuminate. Frontal costa compressed. Pronotum above rounded; lateral carina obliterated in front of last transverse sulcus, blunt back of it ..... *Chromacris* Walker
        - dd. Fastigium of the vertex obtuse. Frontal costa not compressed or sulcate.
          - e. Median carina of the pronotum not cristate. Head somewhat smooth. Frontal costa above the antennæ obtusely sulcate ..... *Zoniopoda* Stål
          - ee. Median carina of the pronotum elevated into a crest which is interrupted by the sulci so as to form lobes ..... *Tropidacris* Scudder

- cc. Wing with that portion just back of the vein which divides the first and second parts not dilated nor provided with transverse parallel veins. Fastigium of the vertex rounded and fading into the frontal costa.  
*Diponthus* Stål
- aa. Posterior tibiae with the apical spine absent from the upper outer margin.
- b. Posterior tibiae more or less flattened toward the apex, the margins acute.
- c. Mesosternal lobes contiguous nearly throughout in a straight line. (Tegmina acuminate.)
- d. Fastigium of the vertex as long or longer than the eyes.
- e. Fastigium of the vertex with a single deep groove. Interocular space of the vertex very narrow ..... *Leptysma* Stål
- ee. Fastigium of the vertex provided with four narrow shallow grooves. The interocular space wider ..... *Leptysmia* Giglio-Tos
- dd. Fastigium of the vertex shorter than the eyes ..... *Arnilia* Stål
- cc. Mesosternal lobes more or less distant.
- d. Pronotum with its hind margin rounded.
- e. Prosternal tubercle transverse, broad, the apex truncate. (Frontal costa complete, gently sulcate, the lateral carinae acute. Facial carinae strongly converging below. Lower edge of sides of pronotum straight.)  
*Oxybleptella* Giglio-Tos
- ee. Prosternal tubercle conical, somewhat acute.
- f. Body graceful. Front strongly oblique. Head much exserted, conical. Antennae distinctly ensiform. Eyes greatly elongate, viewed from above strongly convergent, forming an acute angle. Pronotum distinctly dilated posteriorly, the lower edges of side oblique, straight or nearly so. Elytra dilated toward their apex .... *Inusia* Giglio-Tos
- ff. Body heavier. Front less strongly oblique. Head less exserted, not conical. Antennae filiform or weakly subensiform. Eyes not or but little elongate, viewed from above gently convergent, forming an obtuse angle. Pronotum but little or not at all dilated posteriorly, the lower edge of lateral lobes on the posterior half straight, on the anterior half emarginate. Tegmina narrowed toward the apex. Pronotum cylindrical. Frontal costa below the ocellus and lateral carinae of the face subobsolete ..... *Stenopola* Stål
- dd. Pronotum with its hind margin obtusangulate, the apex not incised. Tegmina greatly surpassing the tip of hind femora.
- e. Frontal costa between the antennae more prominent, subdilated. Eyes more convergent and farther removed from the front edge of the pronotum. Tegmina subacuminate ..... *Cornops* Scudder
- ee. Frontal costa less prominent, and not dilated between the antennae. Eyes less divergent, and nearer to front edge of the pronotum. Apex of the tegmina distinctly rounded ..... *Paracornops* Giglio-Tos
- bb. Posterior tibiae terete, not laminate, the margins rounded.
- c. Posterior tarsi with the first and second joints subequal in length. Fastigium of the vertex horizontal or subhorizontal, somewhat prominent. The front strongly oblique. Tegmina as long or longer than abdomen. Pronotum subcylindrical ..... *Bucephalacris* Giglio-Tos
- cc. Posterior tarsi with the second joint distinctly shorter than the first.
- d. Fastigium of the vertex triangular or in front truncate, divided from the frontal costa by a transverse carina or distinct angle.
- e. Upper carina of hind femora smooth, at most provided with punctures from which emanate stiff hairs.
- f. Interval between the mesosternal lobes narrower than the lobes themselves, distinctly longer than wide.

- g. Pronotum smooth, the transverse sulci profound and deeply impressed, the hind lobe elevated. Head large and strongly exerted.  
*Adimantus* Stål
- gg. Pronotum more or less strongly punctate, granulose or rugose, the transverse sulci less profound, the hind lobe not elevated. Head less exerted.
- h. Pronotum very strongly rugose, the median carina very strong and lobed between the transverse sulci ..... *Zygolistrum* Rehn
- hh. Pronotum granulose or punctate, the median carina less strong, not lobed between the sulci.
- i. Larger. Green or greenish. Metasternal lobes in the female distant. Frontal costa above the antennæ narrowed, evenly amplified throughout. Space between the eyes not narrower than widest part of frontal costa. Posterior extremity of pronotum obtusangulate, the lower lateral edges nearly straight, distinctly incrassate ..... *Aleuas* Stål
- ii. Smaller. Testaceous, ferruginous, or fuscous. Metasternal lobes in female contiguous. Frontal costa moderately dilated between the antennæ, plane, punctate; sulcate below the ocellus and continued to the clypeus. Space between the eyes nearly or quite as wide as the frontal costa. Posterior extremity of the pronotum subrotund, the lower lateral edges in front distinctly sinuate. Tegmina densely reticulate.  
*Paraleuas* Giglio-Tos
- ff. Interspace between mesosternal lobes of about equal width with the lobes themselves, quadrate.
- g. Frontal costa very prominent and strongly dilated between the antennæ, plane. Valves of ovipositor slender, long, and straight.  
*Orthoscapheus*, new genus
- gg. Frontal costa not unusually prominent nor dilated between the antennæ, punctate, or sulcate. Valves of ovipositor normal.
- h. Body cylindrical or subcylindrical, the sexes subequal in size; lower branch of male cerci much longer than the upper.  
*Jodacris* Giglio-Tos
- hh. Body decidedly compressed, the sexes very unequal in size. The two branches of the male cerci of about the same length.  
*Omallotettix*, new genus
- ee. Upper carina of hind femora more or less serrate. Fastigium of the vertex horizontally projecting, acuminate.
- f. Pronotum rugose with the hind margin rounded, the median carina visible throughout. Tegmina and wings somewhat abbreviated. Vertex between the eyes moderately broad ..... *Vilerna* Stål
- ff. Pronotum at most coarsely punctate on posterior lobe, the hind margin angulate and with the median carina obliterated between the transverse sulci. Tegmina and wings greatly surpassing the abdomen.
- g. Vertex between the eyes very narrow. Pronotum with the lateral carinæ acute, straight, parallel. Tegmina with the apex rounded. Hind femora greatly incrassate ..... *Xiphola* Giglio-Tos
- gg. Vertex between the eyes rather wide. Pronotum with the lateral carina less acute, straight but evenly divergent posteriorly. Apex of tegmina obliquely subtruncate. Hind femora only moderately incrassate ..... *Osmiliola* Giglio-Tos
- dd. Fastigium of the vertex deflexed or horizontal, gently fading into the frontal costa.

- e. Mesosternal lobes longer than wide, their internal margin straight. *Schistocerca* Stål
- ee. Mesosternal lobes transverse or of equal width and length, their internal margin rounded.
- f. Posterior tibiae furnished with 8 or sometimes more than 8 spines in the outer row.
- g. Tegmina equaling the abdomen in length or abbreviate, never lobiform or rudimentary, always with the inner margins overlapping.
- h. Head small, not exserted, the hind part narrower than front edge of pronotum; occiput and vertex on the same plane with the pronotum ..... *Atrachelacris* Giglio-Tos
- hh. Head distinctly exserted, the posterior part of equal width or very little narrower than pronotum.
- i. Pronotum decidedly dilated posteriorly. Cerci of the male slender, pointed at apex ..... *Dichroplus* Stål
- ii. Pronotum subcylindrical, but little broadened posteriorly. Male cerci more or less amplified at apex.
- j. Female with the valves of the ovipositor normal, acute. Male cerci fairly broad and obliquely docked at apex. *Leiotettix*, new genus
- jj. Female with the valves of the ovipositor slender, straight, the upper ones much the longer. Male cerci variable, spatulate or slender and curved at apex ..... *Scotussa* Giglio-Tos
- gg. Tegmina lobiform, lateral, widely separated, or with their inner edges nearly, but never quite touching.
- h. Pronotum with the posterior margin rounded or subangulate.
- i. Head very large, the hind portion wider than the pronotum; the labrum large. Frontal costa prominently dilated between the antennæ. Prosternal spine minute. Tegmina lateral, the dorsum of abdomen exposed between them. Subgenital plate subglobose at apex, the cerci, except at base, stiliform, bent upwards ..... *Parascopas*, new name
- ii. Head large, but not broader than the pronotum; the labrum normal. Frontal costa not at all or but little dilated between the antennæ. Prosternal spine elevated, not minute. Tegmina with their inner edges nearly touching. Subgenital plate triangularly produced, the cerci variable.
- j. Male cerci laminately compressed. Chief color of insect green or greenish ..... *Chlorus* Giglio-Tos
- jj. Male cerci long and slender, the apex pointed and decurved. Chief color of insect ferruginous ..... *Eurotettix*, new genus
- hh. Pronotum with the posterior margin truncate or roundly emarginate ..... *Paradichroplus* Brunner
- ff. Posterior tibiae generally with less than 8 spines, usually with 6 to 7, in outer row. Frontal costa percurrent, straight, not at all or but little produced between the antennæ. Tegmina and wings fully developed ..... *Osmilia* Stål

#### PROCOLPIA MINOR Giglio-Tos.

*Procolpia minor* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, No. 184, IX, 1894, p. 17; No. 377, XV, 1900, p. 3.

While the collections contain no specimens of this insect, it has been reported from Asuncion.

**MUNATIA AUSTRALIS**, new species.

General color brownish ferruginous, only varied by having the pronotal carina and a median line on occiput to fastigium testaceous. In the male this line is also continued on the dorsal edge of tegmina for half their length. Much smaller than *M. punctata* Stål, from which it differs markedly otherwise by having the pronotal carina blunt and smooth instead of thin and irregularly serrate.

Head rather small, the vertex horizontal, acuminate, extending in front of the eyes about twice as far (female) or a trifle more (male) as their distance apart, broadly and shallowly sulcate; frontal costa prominent above, widening gently to just below the ocellus, where the carinae unite for a short distance and again gently separate and continue to the clypeus, just before reaching which they diverge more abruptly, sulcate from between the antennae; lateral carinae of face interrupted, the face provided with several prominent longitudinal rugae and elevated points; cheeks also more or less coarsely rugose. Pronotum widening posteriorly, very coarsely and sparsely rugose above, less so on sides, the last transverse sulcus quite profound, situated about the middle; median carina smooth, blunt, not greatly elevated; hind margin acute, front margin angulate, with the apex deeply notched. Tegmina and wings considerably surpassing the tip of abdomen; the wings yellowish (female) or blue (male) basally, more or less fuliginous beyond. Hind femora only moderately robust, quite rough and provided with 5 or 6 short spines on outer edge of lower side, as long as the abdomen; the inner spines of tibiae rather heavy.

Length of body, male, 27, female, 40; of antennae, male, 14, female, 16; of pronotum, male, 7.25, female, 10.5; of tegmina, male, 26, female, 35; of hind femora, male, 14, female, 20 mm.

*Type*.—Cat. No. 9722, U.S.N.M.

*Habitat*.—Sapucay, a number of both sexes, W. T. Foster, collector.

**PRIONOLOPHA SERRATA** (Linnaeus).

*Gryllus (Bulla) serratus* LINNAEUS, Syst. Nat., 10th ed., 1758, p. 427.

*Acridium serratum* DE GEER, Mém. Ins., III, 1773, p. 493, pl. xli, fig. 6.

*Pamphagus serratus* THUNBERG, Mém. Acad. St. Petersb., V, 1815, p. 260.

*Xiphocera serrata* BURMEISTER, Handb. Ent., II, 1838, p. 614.

*Tropinotus serratus* SERVILLE, Hist. Ins., Orthopt., 1839, p. 618.

*Acrydium serrato-fasciatum* DE GEER, Mém. Ins., III, 1773, p. 495, pl. xlii, fig. 2.

*Pamphagus lateralis* THUNBERG, Mém. Acad. St. Petersb., V, 1815, p. 260.

*Prionolopha serrata* STÅL, Recens. Orthopt., I, 1873, p. 44.

Several specimens of both sexes are at hand. They come from San Pedro, San Bernardino, Sapucay, and Asuncion. Also reported by Giglio-Tos.

A second species of the genus, *P. brevipennis*, is described by Giglio-Tos<sup>a</sup> as coming from the Matto Grosso Plateau in Brazil. It may also reach northern Paraguay.

<sup>a</sup> Boll. Mus. Zool. Anat. Torino, No. 377, XV, 1900, p. 4.

## TROPINOTUS Serville.

Since Paraguay seems to be the center of abundance of the species belonging to the genus *Tropinotus* it might be well to append a brief synoptic table for separating all the known forms, together with those here described.

## TABLE FOR DETERMINATION OF SPECIES.

- a. Crest of the pronotum more or less crenulate or even serrulate posteriorly. Genicular angles of hind femora acute, a little lengthened.
- b. Tegmina and body cinereous, testaceous, or ferruginous, usually more or less mottled with brown.
- c. The markings of tegmina large, forming more or less well-defined bands.
  - d. Hind tibiae 12-spined. The wings with the anterior field as well as disk colored bright rose.....*rosulentus* Stål
  - dd. Hind tibiae 9-10 spined. The anterior field of wing more or less infuscated.
  - e. Hind femora very long, reaching considerably beyond the tip of abdomen in both sexes. Crest of pronotum deeply cleft by all three sulci, the lobes distinctly separated.....*discoideus* Serville
  - ee. Hind femora shorter, only reaching the tip of abdomen (female) or but little surpassing it (male). Crest of pronotum less deeply cleft, the lobes closely approximate.
  - f. Larger; general color cinereous or testaceous, the maculation of tegmina, composed of several transverse bars and distributed over most of wing.
  - g. Wings long, narrow. Carina of pronotum less arched, confined to Brazil and southward.....*angulatus* Stål
  - gg. Wings broad, shorter. Carina of pronotum high and strongly arched. Yucatan and Honduras.....*mexicanus*, new species.<sup>a</sup>
  - ff. Smaller; general color ferrugineo-testaceous, the tegmina with but a single triangular basal maculation.....*schulzi* Bruner
- cc. Markings of tegmina small, irregularly scattered over the wing save for a row in basal half of discal area.
  - d. Pronotum short, the crest low, and but little produced posteriorly. Hind tibiae with 9 spines in outer row.....*modestus* Giglio-Tos
  - dd. Pronotum longer, considerably produced posteriorly. Hind tibiae with 10 spines in outer row.....*conspersus* Bruner
- bb. Tegmina and body uniformly colored, without maculation or conspersing.
  - c. Tegmina, as well as entire body and legs, green.....*insignis* Giglio-Tos
  - cc. Tegmina, body and legs uniformly dull brown save a paler dorsal stripe on the former.....*affinis*, new species
- aa. Crest of pronotum smooth posteriorly. Genicular angles of hind femora shorter and more rounded.
  - b. Hind tibiae provided with fewer (10) spines in outer row. General color, dark cinereous.....*regularis* Bruner
  - bb. Hind tibiae provided with more (11-19) spines in outer row. Color variable.
  - c. Color largely green; the discal area of tegmina with or without dark spots.
  - d. Posterior femora punctate, and with all the carinae nigro-serrate. Hind tibiae armed with 11 or 12 spines on outer side (San Leopold, Central Brazil).....*scabripes* Stål

<sup>a</sup> These two species are before me as I write, hence are included herewith. The Mexican species will be described in the *Biologia Centrali Americana* when the proper place is reached. The other is sufficiently distinct to be recognized by the diagnosis given here. This last may also occur in Paraguay.

- dd. Posterior femora nearly smooth, only partially nigro-punctate on the carinae. Hind tibiae armed with 13 to 16 spines on outer row.
- e. Larger and more robust (36 male, 51 female, mm.); the disk of tegmina provided with a row of prominent dark subquadrate spots. Hind femora rather robust basally. The tibiae 13 or 14 spined ... *laripes* Stål
- ee. Smaller and slenderer (30 male, 40 female, mm.). Disk of tegmina immaculate or only showing traces of the discal spots. Sometimes with the body and tegmina more or less infuscated. Hind femora slender. The tibiae 15 to 16 spined. (São Paulo, Brazil.)  
*gracilis* Bruner<sup>a</sup>
- cc. Color ochreous or ferrugineo-testaceous.
- d. Hind tibiae with 11-12 spines in outer row. Crest of pronotum arcuate. Tegmina with a pale costal line ..... *lineatus*, new species
- dd. Hind tibiae with 18-19 spines in outer row. Crest of pronotum straight. Tegmina without a costal line ..... *laufferi* Bolivar

#### TROPINOTUS DISCOIDEUS Serville.

*Tropinotus discoideus* SERVILLE, Hist. Orthopt., 1839, p. 619.

*Tropidonotus discoideus* STÅL, Obs. Orthopt., III, 1878, p. 19.

*Habitat*.—This insect is represented by 9 male and 12 female specimens collected by W. T. Foster at Sapucay (coll. U. S. Nat. Mus.); by others from Asunción (coll. L. Bruner), and is reported from various Paraguayan localities (Giglio-Tos).

#### TROPINOTUS ANGULATUS Stål.

*Tropinotus angulatus* STÅL, Recens. Orthopt., I, 1873, p. 44.

*Tropidonotus angulatus* STÅL, Obs. Orthopt., III, 1878, p. 19.

*Habitat*.—Specimens of this species are at hand from Asunción (L. Bruner, collector); it is also credited to Paraguay by Giglio-Tos.

#### TROPINOTUS MODESTUS Giglio-Tos.

*Tropidonotus modestus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 16.

*Habitat*.—This species, while not recorded directly from Paraguay, was taken in the adjoining parts of the Argentine Chaco. It undoubtedly occurs likewise in Paraguayan territory.

#### TROPINOTUS INSIGNIS Giglio-Tos.

*Tropidonotus insignis* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 16.

*Habitat*.—While this insect was first described from northwestern Argentina it has since been reported from Córdoba and Santa Fe, and from the Bolivian Chaco. It is very likely found in Paraguay as well.

#### TROPINOTUS AFFINIS, new species.

Apparently quite closely related to *T. scabripes* Stål, but differing from it in a number of points sufficiently to warrant me in describing it as new. As compared with that species, *affinis* is a little larger and

<sup>a</sup> See footnote on preceding page.

perhaps a trifle more robust. Its hind femora are rather profusely and evenly granulated with black, and have all the carinæ decidedly nigro-serrate as in *scabripes*. The median carina of the pronotum is moderately elevated, evenly and gently arcuate, the transverse sulci quite profound but with the different sections more closely approximate than in *discoideus*, the hind lobe somewhat the longer and acute angled behind; lateral carinæ prominent and bowed outward in middle. Tegmina long, slender, tapering; very closely veined on basal half, less so on apical, without markings. Posternal spine rather large and long, directed posteriorly but not reaching the front edge of the mesosternum, not sulcate in front as in *scabripes*.

General color above brownish ferruginous, a little paler below; the dorsal field of tegmina testaceous; occiput and fastigium of vertex also with a narrow line on each side of same color. Hind wings long and narrow, the disk orange red; hind margin and obliquely inwardly directed band, along with basal half of anterior field dark fuscous, the apical portion faintly clouded, the scalariform space transparent, vitreous. Hind tibiæ brownish with a faint lavender tint, the tarsi fuscous. Antennæ pale on basal half, infuscated apically.

Length of body, female, 45, of pronotum, 15, of tegmina, 37, of hind femora, 24, of antennæ, 16 mm.

*Type*.—Cat. No. 9732 U.S.N.M.

*Habitat*.—Sapucay, Paraguay, a single female collected by W. T. Foster in February.

While the writer is unacquainted with *T. scabripes* Stål, to which this insect seems to be quite closely related, it seems to be distinct.

#### TROPINOTUS REGULARIS Bruner.

*Tropinotus regularis* BRUNER, Ent. News, XVI, 1905, p. 214-215.

The present collection contains 9 males and 8 females of this insect. Since the female was not described when the species was named, and because of the material now at hand showing some variation, the additional description is here presented.

Besides being much larger and more robust than the opposite sex, some specimens of both the male and the female insects exhibit a few of the color variations of *T. lævipes* Stål, but differ from it by the much shorter and more robust hind femora and in being either altogether or largely brown and black. The female, like the male, has the discal field of the tegmina regularly maculate with black quadrate spots well toward the apex. In some specimens the dorsum of pronotum is largely and the tegmina above the discal row of maculations entirely green, in others the lower apical half and a narrow subcostal stripe on the basal half is cinereous. Hind femora prominently provided with dusky bands externally and above, the lower sulcus and inner face testaceous; the hind tibiæ testaceous more or less regularly conspersed with fuscous.

Length of body, male, 28, female, 43; of pronotum, male, 9, female, 14; of tegmina, male, 24, female, 31; of hind femora, male, 16.5, female, 24; of antennæ, male, 10, female, 14 mm.

*Type*.—Cat. No. 9720, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, November to March, 9 males and 8 females collected by W. T. Foster (coll. U. S. Nat. Mus.). It is also represented by a single male each in the collection of the Philadelphia Academy of Sciences and in the private one of the writer.

#### TROPINOTUS SCABRIPES Stål.

*Tropidonotus scabripes* STÅL, Obs. Orthopt., III, 1878, p. 19.

*Tropinotus scabripes* BRUNER, Ent. News, XVI, 1905, p. 215.

*Habitat*.—Recorded from central Brazil in company with the following species. It is very evidently also to be found in northern Paraguay, since the species of this genus seem to be rather widely distributed if suitable environment is to be had.

#### TROPINOTUS LÆVIPES Stål.

Plate XXXVII, fig. 7.

*Tropidonotus lævipus* STÅL, Obs. Orthopt., III, 1878, p. 20.

*Tropinotus lævipus* BRUNER, Ent. News, XVI, 1905, p. 215.

*Habitat*.—Four males and four females, Sapucay, Paraguay, collected by W. T. Foster.

This is by far the commonest species in Argentina and is found as far south as Buenos Aires.

#### TROPINOTUS GRACILIS Bruner.

*Tropinotus gracilis* BRUNER, Ent. News, XVI, 1905, p. 215.

This, the most slender of the known forms, will probably be found in eastern Paraguay, as well as about Sao Paulo, Brazil, the locality from which the type specimens were obtained.

#### TROPINOTUS LINEATUS, new species.

A medium sized, rather robust insect, the general color of which is dark ferruginous to brown. Pronotal crest smooth; the genicular lobes of the hind femora not greatly elongate nor acute. Disk of the tegmina very obscurely maculate with large brown patches distributed similarly to those in *discoideus*, and provided with a narrow subcostal testaceous line that reaches from the base to a little beyond the middle.

Head of medium size, nearly as wide above as below; the occiput provided with a well-defined longitudinal median carina which extends to the fastigium of the vertex; vertex nearly (male) or quite (female) as broad as the longest diameter of one of the eyes, fastigium a little less than a right angle, the walls prominent; frontal costa only moderately

prominent, narrowed above, gently sulcate and more (female) or less (male) strongly punctate; face quite strongly punctate, cheeks somewhat rugose; antennæ with the joints of basal half somewhat depressed. Pronotum strongly crested, the median carina smooth, plainly cut by all three of the transverse sulci; lateral carinæ also cut by the sulci, in some specimens faintly crenulate; disk granulose, and on the hind lobe provided on each side with four or five fine ridges parallel to lateral margins; lateral lobes profusely punctate; hind and front margins both acute, the hind lobe nearly twice as long as the front one. Tegmina profusely veined on basal, less so on apical half, extending beyond the tip of hind femora and abdomen in the two sexes; hind femora moderately robust, the superior carina plainly serrate, genicular lobes subacute, not greatly elongated. Last ventral segment of male abdomen cuneate, the middle strongly carinate.

General color dark ferruginous to brown, in some individuals largely green on occiput, disk of pronotum and the anterior and posterior fields of the tegmina; disk of latter more or less strongly marked with large brown or fuscous patches as in *discoideus*. Principal longitudinal veins basal half of tegmina black conspersed with yellow or testaceous. The characteristic color feature of the tegmina is, however, the narrow pale stripe between the median and subcostal veins, and which has suggested the specific name. Hind femora granulose, the carina more or less strongly conspersed with black on the serrations. Hind tibiæ with the spines black tipped.

Length of body, male, 32, female, 40-42; of pronotum, male, 13, female, 15.5-17; of tegmina, male, 26, female, 34; of hind femora, male, 18, female, 23-24 mm.

*Type*.—Cat. No. 9733 U.S.N.M.

*Habitat*.—Several specimens of both sexes at Sapucay, Paraguay, by W. T. Foster.

#### ALCAMENES Stål.

##### TABLE FOR DETERMINATION OF SPECIES.

- a. Pronotum with the median carina tectiformly elevated. The posterior lobe much longer than the anterior one.
  - b. Anterior and middle sulci of the pronotum obsolete above. Tegmina twice maculate. Hind tibiæ 12-13 spined in outer row.....*granulatus* Stål
  - bb. Anterior and middle sulci of the pronotum strongly impressed, cutting the crest. Tegmina immaculate. Hind tibiæ 10-11 spined in outer row.  
*cristatus*, new species
- aa. Pronotum with the median carina only moderately elevated. The posterior lobe shorter than the anterior one.
  - b. Body slender. The posterior sulcus of the pronotum a little more prominent than the others. Posterior margin obtuse. The hind femora slender.  
*brevicollis* Stål
  - bb. Body heavy. The posterior sulcus of the pronotum strongly impressed. Posterior margin a right angle. The hind femora tumid at the base.  
*clarazianus* Pictet and Saussure

**ALCAMENES CRISTATUS**, new species.

Rather above the medium, moderately robust (female), or somewhat slender (male), the two sexes very unequal in size. Uniformly grass-green, or sometimes bruno-testaceous above, in the former specimens provided with a brownish purple line along the lateral carinæ and hind margin of dorsum of pronotum. The dorsal field of the tegmina also more or less tinged with this color. All the tibiæ and antennæ more or less strongly infuscated. Venter pale yellowish.

Body greatly compressed, much higher than broad. Head about as wide as the front edge of the pronotum, eyes small, elongate, in the male not quite, in the female a trifle more than, one-half as long as the cheeks below them, rather widely separated above; occiput somewhat inflated and provided with a series of fine transverse ridges or rugæ; fastigium of the vertex nearly horizontal, broadly triangular, with a fine longitudinal median carina that continues posteriorly to the occiput; frontal costa moderately prominent between the antennæ, quite narrow above but evenly broadening below, punctate nearly throughout and very gently sulcate in the vicinity of the ocellus. Antennæ of moderate length, somewhat incrassate, the basal joints depressed but not sufficiently so to give to these members even a subensiform appearance, inserted between the upper portion of the eyes. Pronotum tectiform, broadly and evenly arched, rugose at sides, coarsely granulose above, the anterior lobe shorter than the posterior; the transverse sulci continuous, severing both the lateral and median carinæ, anterior and posterior edges acutely produced on occiput and over the base of tegmina; lateral carinæ finely crenulate, the median smooth, and the lower lateral edges provided with a series of smooth pale tubercles. Tegmina coriaceous, very profusely and minutely veined, somewhat abbreviated, elongate triangular, their apices reaching two-thirds (female) or nearly four-fifths to the tip of the abdomen, without maculation. Wings not as long as tegmina. Hind femora slender, in the males a little surpassing, in the females not quite reaching, the tip of the abdomen. Prosternal spine coarse, robust, long, curved to the rear and tapering on apical half, the tip reaching over the base of mesosternum.

Length of body, male, 36; female, 53; of antennæ, male and female, 13.5; of pronotum, male, 19; female, 23; of tegmina, male, 17; female, 23; of hind femora, male, 20; female, 25 mm.

*Type*.—Cat. No. 9723, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, 9 males, 9 females, and 1 nymph. W. T. Foster, collector.

At first glance this insect, on account of its long and strongly crested pronotum, reminds one of a short-winged and diminutive *Prionolopha serrata* which occurs in the same region. The genera *Alcamenes* and

*Prionolopha* seem to be quite closely related—much more so than *Tropinotus* and *Prionolopha* are.

Possibly one or two of the other species of the genus may reach Paraguay as well.

#### ELÆOCHLORA Stål.

##### ELÆOCHLORA TRILINEATA (Serville).

*Xiphicera trilineata* SERVILLE, Hist. Orthopt., 1839, p. 614.

*Elæochlora trilineata* STÅL, Recens. Orthopt., I, 1873, p. 46.

*Habitat*.—Originally described from Brazil. Reported as coming from Paraguay by Giglio-Tos.

I do not know this species.

##### ELÆOCHLORA VIRIDICATA (Serville).

Plate XXXVI, fig. 9, female. Plate XXXVIII, fig. 7, male.

*Xiphicera viridicata* SERVILLE, Hist. Orthopt., 1839, p. 614.

*Elæochlora viridicata* STÅL, Recens. Orthopt., I, 1873, p. 46.

*Habitat*.—Brazil, Paraguay, Uruguay, and Argentina. Represented in the collections from Sapucay, which were taken by W. T. Foster.

This insect was found in Argentina attacking a species of Solanaceous plant of which it seemed very fond.

Other species of the genus occur throughout tropical America and some of which are sure to be found in Paraguay.

#### CHROMACRIS Walker.

##### CHROMACRIS MILES (Drury).

*Gryllus miles* DRURY, Exot. Ins., II, 1773, pl. XLII, fig. 2.

*Rhomalea speciosa* THUNBERG, Mém. Acad. St. Petersb., IX, 1824, p. 104, pl. xiv, fig. 1.

*Acridium speciosum* SERVILLE, Hist. Orthopt., 1839, p. 673.

*Rhomalea miles* var B. PICTET and SAUSSURE, Cat. Acrid., 1887, p. 20.

*Chromacris speciosa* WALKER, Cat. Dermapt. Salt. Brit. Mus., IV, 1870, p. 644.

*Habitat*.—Sapucay, Paraguay, several specimens collected by W. T. Foster. Also recorded by Pictet and Saussure (in their Catalogue d'Acridiens, p. 20), as coming from this country.

##### CHROMACRIS STOLLI (Pictet and Saussure).

Plate XXXVIII, fig. 2.

*Gryllus miles* STOLL, Sauter., 1787, pl. XVI b, fig. 60.

*Rhomalea stoll*i PICTET and SAUSSURE, Cat. Acridiens, 1887, p. 21.

*Chromacris stoll*i REHN, Ent. News, XVI, 1905, p. 38.

*Habitat*.—No specimens are at hand from Paraguayan territory, but it is recorded as coming from there by Rehn. It is also a common insect in northern Argentina and some parts of Brazil.

*Chromacris nuptialis* (Gerstaecker) should also occur within the borders of Paraguay as it is found in adjoining portions of Argentina, Bolivia, and Brazil.

### ZONIOPODA Stål.

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Body and tegmina mostly green or greenish. Wings generally *cærulean*.
- b. Pronotum unicolorous, in no wise striped or banded with yellow or *testaceous*.
- c. Larger (male, 40, female, 52 mm.). Hind femora provided with a transverse preapical black band on each side.....4. *juncorum* Berg
- cc. Smaller (male, 30, female, 36 mm.). Hind femora entirely green
  - 3. *iheringi* Pictet and Saussure
- bb. Pronotum more or less longitudinally striped with yellow or *testaceous*.
- c. All the legs fasciate with red, yellow, and black. Head largely red
  - 1. *tarsata* Serville
- cc. Legs not fasciate with varied colors. Head without the red
  - 2. *similis*, new species
- aa. Body, as well as legs, varied with fuscous or black; the tegmina variable.
- b. Tegmina dark olive to black, the longitudinal veins yellow or *testaceous*. Wings *cærulean*.
- c. Pronotum longitudinally black and yellow striped.
- d. Head largely blood-red.....8. *omnicolor* Blanchard
- dd. Head not varied with red .....7. *emarginata* Stål
- cc. Pronotum not longitudinally striped with black and yellow.
- d. Pronotum glossy black bordered broadly behind and narrowly in front with pale *testaceous* or dirty white. Body and limbs largely black
  - 6. *exilipes*, new species
- dd. Pronotum chiefly yellow or *testaceous*, with a median and a subfrontal black band. Body and limbs largely pale. Knees, coxæ and head red
  - 5. *fissicauda*, new species
- bb. Tegmina blackish-fuscous tessellate with yellow. Wings red...9. *picta* Bolivar

### ZONIOPODA TARSATA (Serville).

#### Plate XXXVII, fig. 2.

*Acridium tarsatum* SERVILLE, *Ann. Sc. Nat.*, XX, 1831, p. 283.

*Zoniopoda tarsata* STÅL, *Recens. Orthopt.*, I, 1873, p. 51.

*Acridium cruentatum* BLANCHARD, in D'Orbigny, *Voy. l'Amer. Merid.*, VI, 1837-1843, Pt. 2, Ins., p. (216), pl. xxvii, fig. 5.

*Habitat*.—Several specimens of both sexes, taken by W. T. Foster, at Sapucay, are before me. It is also reported by Giglio-Tos as coming from Paraguay. It is exceedingly common in Argentina, Brazil, Bolivia, and Uruguay as well, where it is the most prevalent species of the genus.

This insect frequents low, wet places, and is most frequently met with on aquatic plants.

### ZONIOPODA SIMILIS, new species.

A slender green species, with rough pronotum and low, pale median carina that recalls *Z. tarsata*, minus the banded legs and bright red markings of head.

Head moderately large, slightly wider than the front edge of the pronotum; the eyes moderately prominent and separated by a space about equal to their longest diameter; fastigium short, broadly triangular, and separated from the vertex by a deep transverse furrow; frontal costa with its sides nearly parallel, deeply sulcate, and continuous to clypeus; face coarsely punctate. Pronotum slender, subcylindrical, as broad in front as behind, a little contracted in the middle, both laterally and from above, giving the insect a strangulated appearance; the two lobes about equal in length, the transverse sulci rather distinct but not profound; posterior edge obtusangulate, the front edge a little rounded. Tegmina a trifle narrower than in *tarsata*, as long (female) or a little surpassing the tip of abdomen (male). Hind femora slender, not reaching the apex of the abdomen in either sex. Last ventral segment of male abdomen moderately long and pointed, the apex deeply fissate, and in this respect approaching *fissicauda*.

General color, pale olive-green, with some tinge of yellowish on sides and disk of pronotum, and in the male also rose tinted about the coxæ and face; wings pale blue. Legs nonfasciate, the hind tibiæ pale greenish yellow, their apices and the tarsi carmine. Antennæ unicolorous, black or blackish, except basal joint, which is tinged with red.

Length, male, 31, female, 45; of pronotum, male, 6, female, 8; of tegmina, male, 26, female, 35; of hind femora, male, 15.5, female, 21.

*Type*.—Cat. No. 9734, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, January to March, W. T. Foster, 2 males, 2 females.

#### ZONIOPODA IHERINGI Pictet and Saussure.

*Zoniopoda iheringi* PICTET and SAUSSURE, Cat. Acridiens, 1887, p. 27.

*Habitat*.—The collections before me contain a number of specimens of both sexes of this Brazilian insect that were collected at Sapucay. It is also reported by Rehn as coming from Paraguay.

The writer is in possession of a male specimen of this or a closely allied species which has the radial portion of its wings bright rose color instead of cærulean.

#### ZONIOPODA JUNCORUM Berg.

*Zoniopoda juncorum* BERG, in Pictet and Saussure, Cat. Acridiens, 1887, p. 26.

*Habitat*.—While the collections before me do not contain specimens of this beautiful acridian it is reported as coming from a number of localities in Argentina and Bolivia adjoining. Giglio-Tos records it from Paraguay.

#### ZONIOPODA FISSICAUDA, new species.

About the size and form of *Z. tarsata*, Serville, but differing from it in having the pronotum shorter and much smoother and the median carina stronger than there. Instead of longitudinal pale stripes the

pronotum is provided with two conspicuous black collar-like bands, one median and the other just back of the anterior edge. The abdomen is alternately yellow and black-banded, the pleura obliquely yellow and black alternately and the venter yellow. The tegmina have the longitudinal veins yellow and the interspaces transparent bluish lead color, which when folded over the cærulean wings gives to them the appearance of being alternately dark and pale streaked. The head, front, and middle femora, coxæ, and knees of hind legs red, hind femora and tibiæ yellow, the former thrice banded with black, the latter basally and at the apex also black, tarsi and apex of remaining tibiæ likewise black. There are also black bands on both the middle and anterior femora.

The characteristic feature of this species, however, is the very long last ventral segment of the male abdomen, which is fissured to its base, giving to this region the appearance of being provided with exceedingly long cerci which cross at their apices scissor-like.

Length of body, male, 35; female, 45; of pronotum, male, 6.4; female, 8.5; of tegmina, male, 33; female, 40; of hind femora, male, 18; female, 22 mm.

*Type*.—Cat. No. 9735 U.S.N.M.

*Habitat*.—Sapucay, Paraguay, January, W. T. Foster. One male and 1 female.

#### ZONIOPODA EXILIPES, new species.

Very similar in general appearance to *Z. omnicolor* Blanchard, but differing from that species in the absence of reddish tints about the head and the longitudinal bands on the pronotum. It also differs from that insect by lacking the bands on the anterior and middle legs.

Head a trifle inflated, smooth; the vertex rather broad, one and one-half (male), or nearly twice as wide (female) as the shortest diameter of the eyes, separated from the occiput by a well-defined transverse impression; frontal costa rather broad, continuous to clypeus, the sides pinched below the ocellus, flat and coarsely punctate above, sulcate at ocellus and for one-half the distance below; antennæ black, nearly or quite as long as the hind femora. Pronotum with the anterior lobe smooth, tripartite, subtectate on the dorsum, the transverse sulci broad and deep; posterior lobe flat above, closely and finely granulate, the median carina blunt, hind margin obtuse-angled, front margin entire subangled. Tegmina complete in the male and slightly surpassing the tip of the abdomen; in the female somewhat abbreviated, a little more than half the length of the abdomen. Hind femora very slender, not reaching the tip of abdomen even in the male; middle and anterior femora also slenderer than usual in the genus.

General color glossy black, varied on the margins of the face, the anterior and posterior edges of pronotum, the hind edges of meso- and metathorax and abdominal segments, as well as on the front and hind

coxæ and the longitudinal veins of the tegmina with testaceous. Occiput and hind portion of genæ dirty yellow. Hind femora with base, apex, and two bands yellowish testaceous; tibiæ black, in nowise banded. Wings dusky, bluish tinted basally.

Length of body, male 37, female 49; of antennæ, male 17, female 15; of pronotum, male 7, female 9.5; of tegmina, male 30, female 21; of hind femora, male 17, female 19 mm.

*Type*.—Cat. No. 9719, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, 2 males and 1 female.

This insect's relationship to its allies may be seen by a reference to the accompanying synoptic table. Whether or not *emarginata* Stål and *omnicolor* Blanchard are distinct, I am unable to say.

#### ZONIOPODA EMARGINATA Stål.

*Zoniopoda emarginata* STÅL, Recens. Orthopt., I, 1873, p. 52.

*Habitat*.—Stål gives Brazil as the habitat, while Pictet and Saussure simply say "Amérique méridionale."

Whether or not this species is distinct from *omnicolor* Blanchard, I am unable to say. If it is, it may also be looked for in Paraguay.

#### ZONIOPODA OMNIColor (Blanchard).

Plate XXXVII, fig. 3.

*Acridium omnicolor* BLANCHARD, in D'Orbigny Voy. l'Amer. Merid., VI, 1837-43, Pt. 2, Ins., p. 216, pl. XXVII, fig. 3.

*Zoniopoda omnicolor* BRUNER, Locusts of Argent., 1900, p. 61, fig. 27.

*Habitat*.—Several specimens are at hand from Sapucay, Paraguay. They were taken by W. T. Foster. It is also reported by Giglio-Tos and Rehn as a Paraguayan insect.

This species occurs rather commonly at Cordoba, in Argentina, where it is found in colonies upon special food plants, after the manner of *Chromacris stollé*.

#### ZONIOPODA PICTA Bolivar.

*Zoniopoda picta* BOLIVAR, Viaje Pacif., Orthopt., 1884, p. 37.

*Habitat*.—If the writer has rightfully determined this insect, it may also be found in Paraguay. It is not reported from that country by the authors already referred to in connection with the preceding species.

#### TROPIDACRIS Scudder.

##### TROPIDACRIS DUX (Drury)?

*Gryllus dux* DRURY; Illustr. Nat. Hist., II, 1837, new ed., pl. XLIV.

*Habitat*.—Giglio-Tos refers to this insect as being found at Asuncion, Paraguay. It is not represented in any of the collections at hand.

For a discussion of the synonymy the reader is referred to Scudder's paper on "A study of the giant lobe-crested grasshoppers of South and Central America."

Another species of the genus, *T. cristata*, is common along the northwestern borders of Argentina and northward. It is barely possible that it also reaches the mountainous portions of Paraguay.

### DIPONTHUS Stål.

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Tubercle of the prosternum acuminate, retro-arcuate.
  - b. General color green or olive; tegmina immaculate, the margins pale.
    - c. Grass-green; the tegmina grass-green; wings greenish hyaline. Posterior femora on outer face not transversely banded; the tibiæ green, not dotted with black.....*electus* Serville
    - cc. Olive-green; tegmina dilute fuscous; wings subhyaline, rose-color basally, the nervures brown. Posterior femora on the outer face with two bands and the condyle black or blackish; hind tibiæ with base, apex, and spines black.....*dispar* Gerstaecker
  - bb. General color ochraceous or fuscous; tegmina maculate.
    - c. Wings blue, the apex bordered with brown; hind tibiæ black and yellow annulate, not black-dotted.....*festivus* Gerstaecker
    - cc. Wings rose color, tessellate with black; hind tibiæ yellow, dotted with black, apex and base dusky.....*clarazianus* Pictet and Saussure
- aa. Tubercle of the prosternum straight, not retroarcuate.
  - b. Pronotum with the pale lines percurrent, three dorsal, straight; two lateral, suboblique. Body and legs yellow, black, and red; tegmina black tessellate with yellow.....*puelchus* Pictet and Saussure
  - bb. Pronotum with the pale lines not percurrent, except the dorsal one alone in some instances.
    - c. Larger (male, 40, female, 51 mm.). Testaceous conspersed with black.  
*nigro-conspersus* Stål
    - cc. Smaller (male, 24-29, female 30-40 mm.). Color variable.
      - d. Body and legs not black spotted.
        - e. Tegmina for the most part olivaceous or greenish, but slightly maculate with dusky.....*permistus* Serville
        - ee. Tegmina decidedly obscure maculate.
          - f. Anterior and middle legs not largely black; general color dull testaceous, inclining to brown.....*paraguayensis*, new species
          - ff. Anterior and middle legs largely black.
            - g. Pronotum largely black, the bands bright yellow, head and knees ornamented with red.....*schulzi* Bruner
            - gg. Pronotum when black only so on the anterior lobe, the bands testaceous. Head and knees without red.....*argentinus* Pictet and Saussure
      - dd. Body and legs conspicuously conspersed with black.
        - e. Body and legs strongly tinged with rufous or red. Antennæ unicolorous, black.....*pycnostictus* Pictet and Saussure
        - ee. Body and legs along with tegmina greenish or olivaceous. Antennæ annulate with pale.....*communis* Bruner

**DIPONTUS PARAGUAYENSIS, new species.**

About the size and form of *D. schulzi* Bruner, but differing from that species in having the veins of tegmina, the legs and pronotum, together with body testaceous. The darker portions of head, pronotum, and legs in this form are dark olive instead of deep black, as in the species to which it has been compared. The present species also lacks the red markings of the head and knees of that insect.

Head rather small, the fastigium depressed, the vertex between the eyes a little wider than the broadest part of the frontal costa, the latter of nearly equal width throughout (female) or with the sides decidedly convergent below (male), flat above, sulcate at and below the ocellus. Pronotum short, rather coarsely and profusely punctate above and on sides of hind lobe, the latter a very little longer than the anterior one; hind margin very broadly angulate. Tegmina and wings reaching beyond the abdomen in both sexes. Hind femora as long as the abdomen.

The median line of head and pronotum above fades posteriorly, while the oblique lines on the sides of latter are bordered below by a slight infuscation. The cells of the tegmina are fuliginous, with the veins and cross-veins and the edgings of the membrane to a considerable extent testaceous. This gives to these members the appearance of being testaceous and rather evenly conspersed with dull black. The wings deep rose, the apices pale, with dusky veins. Hind femora crossed above by two dark bands; the outer and inner faces have in addition a basal blotch and the upper half of the genæ dark—the latter black; hind tibiæ olivaceous or testaceous, the apex and hind tarsi infuscated. Antennæ dark colored annulate with paler.

Length of body, male 25, female 32; of pronotum, male 4.4, female 5.5; of tegmina, male 22, female 28; of hind femora, male 12.5, female 16 mm.

*Type*.—Cat. No. 9724, U.S.N.M.

*Habitat*.—Two specimens, male and female, from Sapucay, Paraguay (coll. L. Bruner); Sapucay, Paraguay, several specimens of both sexes taken by W. T. Foster (coll. U. S. Nat. Mus.).

It is possible that both *D. dispar* and *D. festinus* of Gerstaecker will also be found to occur in Paraguayan territory. One of the species of this genus, *D. communis* Bruner, is figured herewith on Plate XXXVII, fig. 6.

**LEPTY SMA Stål.**

An examination of all the American locusts that fall into the genus *Leptysma* would indicate that it contains a much larger number of species than generally has been conceded; and, as is recognized at present, it is composed of two series of species, namely, the one more

robust and belonging to North America, and represented by *L. marginicollis*; the other more slender and belonging to South America, with *L. filiformis* as a type. There are at least four readily separable forms of the latter group before me as I write. They may be separated by the accompanying key:

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Apex of male abdomen simple, acuminate. Hind tibiae with numerous (11 to 17) spines in outer row. Sides of head, pronotum, and pleura with a decided narrow ferruginous or piceous band.
- b. Larger (male 27 mm. long). Hind tibiae 17-spined. [Central Argentina.]  
*argentina*, new species
- bb. Smaller (male 25, female 30-32 mm. long). Hind tibiae 11-spined. [Sao Paulo, Brazil.].....*gracilis*, new species
- aa. Apex of male abdomen complex, provided with two rather widely separated, backward projecting, slender fingers, between and above which there is a large contorted process. Hind tibiae with 7 to 11 spines in outer row. Sides of head, pronotum, and pleura less decidedly piceous-banded.
- b. Smaller and slenderer (male 30, female 33-37 mm. long)....*filiformis* (Serville)
- bb. Larger and more robust (male 33, female 40-43 mm. long)..*obscura* (Thunberg)

#### LEPTY SMA FILIFORMIS (Serville)?

There are 4 males and 4 females before me from Sao Paulo, Brazil, which are placed here. I am not quite sure, however, of the determination, although the measurement agrees with that given by Serville in his description of the species. This insect is credited to Paraguay by Giglio-Tos, and to Argentina by Stål.

#### LEPTY SMA OBSCURA (Thunberg)?

There are a number of specimens (4 males and 10 females) in the National collection from Sapucay, Paraguay. These were collected by W. T. Foster. The writer also collected in Paraguay, when several specimens of both sexes were taken at San Bernardino. All of these are larger and somewhat more robust than those referred to above as possibly being *L. filiformis* Serville. They have accordingly been placed under Thunberg's *obscura*.

#### LEPTY SMINA Giglio-Tos.

#### LEPTY SMINA PALLIDA Giglio-Tos

Plate XXXVIII, fig. 1.

*Leptysmina pallida* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 35.

*Habitat*.—Although this insect is not represented in the collections at hand, nor seems to have been reported from Paraguayan territory, it was originally described from Resistencia, Argentina, almost on the borders of Paraguay. It is quite sure to be taken later. The writer has a specimen, presumably of this species, taken by himself at Victoria, Brazil.

## ARNILIA Stål.

## ARNILIA CYLINDRODES Stål.

*Opsomala cylindroides* STÅL, Freg. Eugene Resa, Ins. Orthopt., 1860, p. 325.

*Arnilia cylindroides* STÅL, Recens. Orthopt., I, 1873, p. 85.

This insect was described originally as coming from Rio Janeiro, Brazil, by its author, and later by himself credited to North Carolina as well. Not having specimens of the genus from Rio Janeiro or other Brazilian localities that agree with Stål's description, it has not been recognized by me. I am inclined, however, to consider the North Carolina insect as distinct from the Brazilian.

Giglio-Tos credits *cylindroides* to Paraguay.

## ARNILIA GRACILIS Giglio-Tos.

Two males of a slender *Arnilia*, which the writer collected in 1897 at San Bernardino, Paraguay are referred here.

## ARNILIA COCCINEIPES, new species.

Related to *Arnilia viridis* Serville, but a trifle larger and differing from it in several other respects. General color pale green above, without the lateral white lines of *viridis* and other related species of the genus. Antennæ ferruginous. The dorsum of abdomen also lacks the red of *viridis*, while in the present insect the entire hind tibiae are red, instead of merely the base and apex.

Insect more or less distinctly hirsute throughout, but not profusely so except on lower side of abdomen near its apex. Form cylindrical, slender, the tegmina and wings extending considerably beyond the tip of the abdomen; the former acuminate, rather closely veined on basal half, less so on apical half. Head smooth, the occiput as long as the anterior lobe of the pronotum, the eyes rather large and moderately prominent, very little more pointed above than below, much longer (nearly twice the length) than the cheeks below them; face strongly oblique; vertex rather broad, nearly (male) or quite as wide as the frontal costa in its broadest part (female); the fastigium fairly prominent, a little wider than long, and with the anterior angle somewhat rounded, the margin a trifle elevated; frontal costa prominent above where it is considerably expanded between the base of the antennæ; below this with the sides parallel, deeply sulcate throughout. Pronotum cylindrical, rather shallowly but profusely punctate; the median carina visible only on the posterior lobe; transverse sulci well defined, the last situated back of the middle; front edge subtruncate, hind edge broadly rounded. Meso- and metapleura closely punctate, pectus smooth. Hind femora moderately robust, shorter than the abdomen in both sexes. Hind tibiae with 7 spines in outer row. Prosternum robust, the apex truncate, rather larger than at base. Last ventral seg-

ment of male abdomen long and narrow, slightly curved upward, the apical third with the sides nearly parallel, the point blunt, entire; supraanal plate broad on basal half, suddenly contracted on the apical half, and produced into a rather narrow triangle, the apex of which is acute; basal portion bordered with a rather high wall and with two median longitudinal carinæ; marginal apophyses, longitudinal carinæ, and base of lateral border black. Cerci rather robust, of the usual form in this group, unicolorous-pale. Valves of the ovipositor strongly and quite evenly toothed, the serrations deep piceous.

Length of body, male, 32; female, 40; of pronotum, male, 5.15; female, 6.5; of tegmina, male, 29; female, 36; of hind femora, male, 15.5; female, 18 mm.

*Type*.—Cat. No. 9736, U.S.N.M.

*Habitat*.—San Bernardino and Asuncion, Paraguay, in September several specimens of both sexes (L. Bruner); 1 female, Sapucay, Paraguay (W. T. Foster), in February; Victoria, Brazil, in May (L. Bruner), 1 female.

As indicated above, this insect bears some resemblance to *Opsomala viridis* Serville,<sup>a</sup> but differs from it in lacking the pale lines on sides of body as well as in the absence of the blood-red markings on the abdomen and the pale band on the hind tibiæ.

#### OXYBLEPTELLA Giglio-Tos.

##### OXYBLEPTELLA SAGITTA Giglio-Tos.

*Oxybleptella sagitta* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 33, fig. 7.

*Habitat*.—Villa Rica, Paraguay (Giglio-Tos). Not contained in the material before me, but represented by several specimens received from Sao Paulo, Brazil.

#### INUSIA Giglio-Tos.

##### INUSIA PALLIDA, new species.

*Female*.—A pale green insect with the yellowish lower half of sides of pronotum, cheeks, and pleura separated from the dorsal region by a narrow, obscure piceous band. Head, pronotum, and sides of meso- and metathorax profusely but not deeply punctate.

Head small, a little narrower than the front edge of the pronotum; the eyes of medium size, not at all prominent, separated above by a space a little broader than the widest part of the frontal costa; fastigium horizontal, triangular, about three-fourths as long as one of the eyes, the extreme apex bluntly rounded; frontal costa a little prominent, slightly widest between the antennæ, sulcate throughout and

<sup>a</sup>Rev. Mét. Ins., Orthopt., p. 77.

continuous to the clypeus. Antennæ with the basal joints depressed. Pronotum somewhat expanded on posterior lobe, the last transverse sulcus decidedly back of the middle; anterior edge roundly advanced upon the occiput, the posterior margin of disk also broadly rounded, but little elongated. Tegmina and wings extending nearly one-third of their length beyond the apex of the abdomen, the former a little broadened toward the apex, the latter subacuminate. Hind femora moderately robust, almost as long as the abdomen; hind tibiæ with 7 spines in outer row and 10 in the inner. Mesosternal lobes with their inner edge evenly rounded, separated by a space nearly as broad as long. Prosternal spine moderately robust, bent backward and acuminate.

General color above pale green, the lower portion of cheeks, sides of pronotum; pleura and venter flavous, bordered above from the back edge of eyes to the base of tegmina by a narrow inconspicuous fuscous band. Hind tibiæ dull plumbeous, the tarsi reddish. Antennæ ferruginous.

Length of body, female, 27.5; of pronotum, 5.1; of tegmina, 21; of hind femora, 14 mm.

*Type*.—Cat. No. 9737, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, a single female specimen (W. T. Foster).

The type of the genus, *I. gracillima* Giglio-Tos, may reach Paraguayan territory, as it was taken at Caiza, in the Bolivian Chaco. Judging from its description, it must be a much slenderer insect than *pallida*. Other species of the genus occur in northern South American regions, as well as in Central America and southern Mexico.

#### STENOPOLA Stål.

##### STENOPOLA PUNCTICEPS Stål.

*Opsomala puncticeps* Stål, Freg. Eugene Resa, Ins., Orthopt., 1860, p. 325.

*Stenopola (Oxyblepta) puncticeps* Stål, Recens. Orthopt., I, 1873, p. 84.

*Habitat*.—Sapucay, Paraguay, W. T. Foster, collector. Also reported by Giglio-Tos as coming from Paraguay.

##### STENOPOLA BOHLSII Giglio-Tos.

*Stenopola bohlsii* GIGLIO-TOS, Zool. Jahrb., VIII, p. 813.

? *Stenopola puncticeps* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 31.

*Habitat*.—A number of specimens of both sexes are before me from Sapucay, Paraguay, most, if not all, of which were collected by W. T. Foster. It is represented in the collections of the author and that of the U. S. National Museum. It was described from Paraguayan specimens.

## PARACORNOPS Giglio-Tos.

This genus is based on the insect which has been determined by Giglio-Tos as De Geer's *Acridium longipenne* which, according to that author, came from Surinam (Dutch Guiana). Without having material from that country for comparison, it would be a difficult matter to definitely recognize the insect to which De Geer gave the name *longipenne*.

Be this as it may, Stål thought that he recognized in an insect from Brazil De Geer's species, and placed it in Scudder's genus *Cornops*.<sup>a</sup> Later Giglio-Tos<sup>b</sup> recognized the generic distinctness of *Cornops bivittatum* Scudder and the *Acridium longipenne* De Geer. He therefore suggested the name *Paracornops* for the De Geerian species.

By a rather careful study of the description and figure it would appear that if De Geer's insect really occurs in the region under consideration in the present paper, and is contained in the material at hand, we will have to tabulate the species as follows:

## TABLE FOR DETERMINATION OF SPECIES.

- a. Upper valves of ovipositor provided externally with 4 or 5 large teeth. General color of insect greenish ferruginous above, testaceous on sides and below. More finely and closely punctate:
  - b. Smaller (male 19, female 25 mm.). The lower lateral edges of pronotum somewhat sinuate ..... *longipenne* (De Geer)
  - bb. Larger (male —?, female 33). The lower edges of pronotum not sinuous. .... *paraguayense*, new species
- aa. Upper valves of the ovipositor provided externally with 6 or 7 small teeth. General color of insect grass-green or olivaceous above, greenish yellow below. More coarsely and sparsely punctate.
  - b. Punctuation of pronotum and pleura quite regularly distributed, leaving no decided glabrous patches. Hind femora much surpassing the abdomen. .... *aquaticum*, new species
  - bb. Punctuation of pronotum and pleura somewhat irregularly distributed, leaving glabrous patches on sides of pronotum and pleura. Hind femora only a trifle surpassing the abdomen ..... *politum*, new species

## PARACORNOPS LONGIPENNE (De Geer)?

This insect is included as a Paraguayan species on the authority of Giglio-Tos, who gives its habitat as the province of San Pedro. There are several specimens, male and female, in the writer's collection which come from Sao Paulo, Brazil, a short distance to the eastward, which have been determined as this species. They are darker colored than De Geer's description would indicate, but for size and markings would be just about right.

Length of body, male, 19, female, 25; of pronotum, male, 4, female, 5; of tegmina, male, 19, female, 23.5; of hind femora, male, 12, female, 15; of antennæ, male, 7.5, female, 6.5 mm.

No synonymy is given for this insect at present, but will be later in a paper under contemplation.

<sup>a</sup>Syst. Acrid., 1878, p. 40.<sup>b</sup>Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 31.

**PARACORNOPS PARAGUAYENSE, new species.**

In color and general appearance very similar to the insect here accepted as the *longipenne* DeGeer, but differing from that insect in its much larger size and paler color. It also varies from *longipenne* in having the lower lateral edges of the pronotum less sinuate, while the prosternal spine in the present species is very long and slender as compared with the shorter and rapidly tapering one of the other insect. Frontal costa scarcely expanding between the antennæ, shallowly sulcate, and with the carina not converging at the ocellus.

Length of body, female, 33; of pronotum, 6; of tegmina, 28; of hind femora, 16.5; of antennæ, 8.25 mm.

*Habitat*.—San Bernardino, Paraguay, a single female collected by the writer during the month of September. It was taken among the rank grasses growing in an open glade near a lake.

**PARACORNOPS AQUATICUM, new species.**

General color above grass-green, on the sides and below greenish yellow. Sides of head back of the eyes and upper portion of the sides of pronotum and upper portion of pleura, together with a small basal portion of the costal margin of the tegmina, washed with piceous, which marking is most apparent in the male.

Head of moderate size, in the male a trifle narrower, in the female about as wide as the front edge of the pronotum, the occiput short; eyes fairly prominent in both sexes, the vertex about as wide (female) or a little more than one-half the width of the frontal costa (male), the fastigium short, broad, blunt, centrally gently sulcate; frontal costa prominent above where it is somewhat narrowed, as it is also below the ocellus, shallowly and broadly sulcate; the surface coarsely punctate; punctuations of the face piceous, giving it the appearance of being profusely freckled. Antennæ filiform, about equal to (female) or a very little longer than (male) the head and pronotum taken together. Pronotum subcylindrical, a little expanding on the hind lobe, profusely and rather coarsely punctate; median carina percurrent, but not prominent; the anterior margin roundly advanced upon the occiput, hind margin obtusangulate (male) or subrotund (female). Tegmina rather narrow, their apex subacuminate as compared with *longipenne*, extending one-third (male) or one-fourth (female) of their length beyond the tip of the abdomen. Hind femora rather robust and long, surpassing the abdomen in both sexes; hind tibiæ unusually broad on their apical portion, the outer edge 7-spined. Prosternal spine short, coarse, and blunt, slightly transverse. Last ventral segment of male abdomen short, the sides of apex provided with a blunt tooth; the supraanal plate marked with two narrow subbasal lines and two black dots.

Length of body, male, 19.5, female, 24.5; of pronotum, male, 4.5, female, 5.25; of tegmina, male, 21, female, 24; of hind femora, male, 13, female, 16 mm.

*Type*.—Cat. No. 9738, U.S.N.M.

*Habitat*.—San Bernardino, in September, 1 male, collected by the writer; also a female from Sapucay, April, W. T. Foster, collector.

The insects which form the basis of the above description appear to belong together, although the pronotum of the female specimen is much less angulate on the hind margin of its disc than that of the male. The male specimen may be considered the type of the species.

#### PARACORNOPS POLITUM, new species.

Very similar to *P. aquaticum* Bruner, but with shorter and more pointed tegmina. Vertex quite deeply sulcate. The hind femora are shorter and somewhat less robust, while the sides of the pronotum are almost without indications of the piceous band. The pronotum is less profusely punctate on the prozona and has the sides largely without punctures except on the hind lobe. The color of the entire insect is a smoky green inclining to brown. The antennæ are shorter than the head and pronotum combined. The prosternal spine is short and rather coarse, cylindrical, the apex blunt.

Length of body, female, 25; of pronotum, 5.5; of tegmina, 22; of hind femora, 14.75; of antennæ, 6.75 mm.

*Habitat*.—The single specimen, a female, comes from Rio de Janeiro, Brazil, where it was taken by myself on some water plants growing in the Botanical Gardens just outside of the city. This specimen is in the writer's collection. The species may also occur in Paraguay.

#### CORNOPS Scudder.

##### CORNOPS BIVITTATUM Giglio-Tos.

*Cornops bivittatum* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 32.

*Habitat*.—Asuncion, Paraguay (Giglio-Tos). Not in the collections studied.

##### BUCEPHALACRIS Giglio-Tos.

The genus *Bucephalacris* was established by Giglio-Tos<sup>a</sup> for an insect which he took to be the *Gryllus bucephalus* of Marschall.<sup>b</sup> Later he recognized it as distinct and described it as *B. borellii*. The writer has specimens from British Guiana that appear to be Marschall's insect without any doubt. These are quite distinct and do not even fall in the same genus as characterized by Professor Giglio-Tos.

<sup>a</sup> Boll. Mus. Zool. Anat. Comp. Uni. Torino, IX, 1894, No 184, p. 30.

<sup>b</sup> Ann. Wiener Mus., 1835, p. 217, No. 10, pl. xviii, fig. 9.

**BUCEPHALACRIS BORELLII** Giglio-Tos.

*Bucephalacris borellii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 31.

*Gryllus bucephalus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 31, not Marschall.

*Habitat.*—Credited to the Province of San Pedro, Paraguay, where it was taken by Doctor Borelli (Giglio-Tos).

**BUCEPHALACRIS PARAGUAYENSIS** new species.

General form cylindrical, not especially robust, the color dull grayish brown, with the lower sulcus and inner face of hind femora deep blood-red; apex of tegmina broadly rounded, a little shorter than both the hind femora and the abdomen; prosternal spine large, short, blunt.

Head a little broader than the front edge of the pronotum, nearly as broad as high; face and cheeks rather evenly and profusely punctate, the occiput smooth; eyes large, prominent, strongly divergent, much longer than the cheeks below them; vertex between the eyes rather narrow, about three-fifths as broad as the frontal costa between the base of antennæ; fastigium slightly depressed, a little broader than long, widely truncate in front and separated from the facial costa by a strong transverse carina, just back of which are two lateral depressions separated by a short posteriorly directed carina or ridge; frontal costa evenly and coarsely punctate, rather broad and prominent above, gently narrowing below, not quite reaching the clypeus, broadly and shallowly sulcate, with the bounding walls blunt and smooth, which, about midway between the antennæ and clypeus, emits a lateral impunctate ridge, which extends a little more than half way to the lateral facial carinæ; antennæ filiform; pronotum subcylindrical, the surface rather evenly and profusely punctate, without lateral carinæ; median carina percurrent, faint, most apparent on hind lobe; anterior edge somewhat advanced upon the occiput, but with the center roundly emarginate, hind border broadly rounded; transverse impressed lines well marked, continuous, the last much back of the middle; pleura and sternum of meso- and metathorax punctate, the mesosternal lobes separated by a space a little longer than broad, the inner edge of the lobes broadly rounded posteriorly; tegmina of medium and equal width throughout, not quite as long as the abdomen, the texture semimembranous and with comparatively few veins, the apex rounded; wings as long as tegmina.

Anterior and middle legs short, their femora but little enlarged and slightly arcuate. Hind femora moderately robust on basal two-thirds, somewhat compressed, the pinnæ quite regular in size, the carinæ low and smooth; tibiæ slender, hairy, with 7 spines in outer row; tarsi long and slender, the first and second joints equal in length. Prosternal spine coarse, short, the apex broadly rounded. Valves of

ovipositor slender, exerted, the basal half of upper pair with three transverse rugæ, apical half slender, scooped out, curved upward and slightly inward; lower pair with a broad basal tooth, the apical half narrowed and curved downward.

General color dull grayish brown. Eyes slightly æneous, more or less clearly longitudinally striped anteriorly with dark brown and testaceous. Sides of head and upper portion of sides of pronotum showing a faint dusky band, below this a paler one; upper edge of clypeus, lower face, and facial carinæ also paler. Tegmina unicolorous, save that a few of the smaller veins and veinlets above near the base are a trifle paler. Hind wings hyaline at base, the apical portion faintly clouded. Hind femora with indication of three fuscous bands, one basal, one median, and the other preapical, most decided across upper edge, and crossing over to upper edge of inner face. Latter, along with lower sulcus, bright blood-red. Hind tibia dirty plumbeous, infuscated apically. Pectus and venter pale dirty yellow.

Length of body, female, 30, of pronotum, 5.1, of tegmina, 17, of hind femora, 14 mm.

*Habitat*.—The type, a single female, was collected by the writer at San Bernardino, Paraguay, during the month of September, 1897. It was taken in a small opening near the edge of a heavy forest, and if memory is not at fault, was collected from the trunk of a small shrub.

#### ADIMANTUS Stål.

##### ADIMANTUS VITTICEPS (Blanchard).

*Acridium vitticeps* BLANCHARD, in D'Orbigny Voy. l'Amer. Merid., VI., 1837-43, Pt. 2, Insect., p. 216, pl. xxvii, fig. 4.

*Habitat*.—Sapucay, Paraguay, W. T. Foster, collector. Specimens of both sexes are at hand.

Should this insect prove to be of the same species as Burmeister's *Oxya ornatissima*,<sup>a</sup> it is quite probable that the Burmeister name would have priority, since D'Orbigny's work began publishing in 1837 and was not completed till 1843, while the Handbuch was published in 1838. Whether the insects are identical or not they are at least congeneric.

##### ZYGOLISTRON TRACHYSTICTUM Rehn.

*Zygolistron trachystictum* REHN, Ent. News, XVI, 1905, p. 39, figs. 1, 2, 3, male.

There are before me as I write 9 males and 3 females of this peculiar locust. Although one would have no difficulty in recognizing the two sexes as belonging to one and the same species, there is sufficient difference between the two to warrant me in presenting herewith a description of the female which Mr. Rehn had not seen when he drew up his description.

<sup>a</sup> Handbuch Ent., II, p. 636.

. As compared with the male it is much more robust, has a larger head, broader and shorter fastigium of the vertex, less prominent eyes, the pronotum is more coarsely rugose, the tegmina are abbreviated, being only about one-half as long instead of a trifle longer than the abdomen. The antennæ of the female are also correspondingly shorter than in the opposite sex, as are also the hind femora. The valves of the ovipositor are not abnormally developed, being of the ordinary type in species of allied genera. In color the sexes are similar, save that perhaps the females will average a little paler, and in lacking to some extent the row of prominent discal spots of the tegmina.

Length of body, female, 54, of pronotum, 11, of tegmina, 20, of hind femora, 21 mm.

*Habitat*—Sapucay, Paraguay, W. T. Foster, 9 males and 3 females collected in February.

This genus seems to have some of the characteristics of the *Zoniopodæ*, but lacks the terminal spine on the outer carina of the hind tibiæ. It also resembles in other respects the genus *Aleuas* which latter genus lacks the terminal spine. Possibly too much stress has been placed by some orthopterists on this spine feature in the arrangement of the genera. I would also suggest the same with reference to the comparative length of the first and second joints of the hind tarsi.

#### ALEUAS Stål.

##### ALEUAS VITTICOLLIS Stal.

*Aleuas vitticollis* Stål., Syst. Acrid., 1878, p. 69.

*Habitat*.—Sapucay, Paraguay, 2 males, W. T. Foster, collector. Reported also from this country by James A. G. Rehn.

The following table for the separation of the species of *Aleuas* will give an idea of the relationship of the previously described forms of the genus, together with the one now characterized:

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Hind tibiæ armed externally with 6 or 7 spines. Wings either fully developed or more or less abbreviated. Pronotum strongly rugose-punctate.
  - b. Tibiæ normally with but 6 spines on the outer margin.
    - c. Tegmina slightly surpassing the apices of the hind femora ..... *vitticollis* Stål
    - cc. Tegmina much abbreviated, less than half as long as the abdomen.
      - brachypterus*, new species
  - bb. Tibiæ with 7 spines on the outer margin. Tegmina and wings surpassing tip of the abdomen..... *gracilis* Stål
- aa. Hind tibiæ armed externally with 8 or 9 spines. Wings always fully developed.
  - Pronotum not rugose, punctate..... *lineatus* Stål

##### ALEUAS BRACHYPTERUS, new species.

Like the previously known species of the genus this insect is pre-vaillingly green or greenish olive in color. Its pronotum has the median carina and a line on either side continuous from the hind mar-

gin of the eyes to the base of elytra black. The hind tibiae are greenish basally and purplish apically; the spines pale, black-tipped.

Head as wide as the front edge of the pronotum, smooth above and at the sides. Vertex between the eyes about as broad as the longest diameter of one of the latter, evenly rounded, not sulcate in the least, separated from the face by low, blunt carinae which meet at the middle in a very obtuse angle. Frontal costa evenly widening downward, flat, gently punctate, its lateral carinae well defined, straight, and continuous to the clypeus; facial carinae less conspicuous, but plain, a little curved at the base of antennae. Pronotum subcylindrical, its surface rugosely punctate, the median carina prominent, cut back of middle by last transverse sulcus; lateral carinae obliterated; lower lateral margins heavily bordered, gently undulate; front border a little advanced on occiput, hind edge obtuse-angled. Tegmina a little less than half as long as the abdomen, oblong ovate, the apex drawn out and pointed, the dorsal edges just touching. Abdomen rather strongly carinate above; valves of ovipositor short, strong, the apices abruptly bent. Hind femora slender, not reaching the tip of abdomen.

Length of body, female, 54, of pronotum, 12.75, of tegmina, 16, of hind femora, 23.5 mm.

*Type*.—Cat. No. 9721, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, a single female specimen (Coll. L. Bruner); 3 males and 3 females (Coll. U. S. Nat. Mus.).

#### ALEUAS GRACILIS Stål.

*Aleuas gracilis* Stål., Syst. Acrid., 1878, p. 70.

*Habitat*.—Four male specimens that were collected at Sapucay by W. T. Foster are at hand. Rehn also reports it from Paraguay.

#### ALEUAS LINEATUS Stål.

Plate XXXVIII, fig. 10.

*Aleuas lineatus* Stål., Syst. Acrid., 1878, p. 70.

*Habitat*.—This is the most abundant and, at the same time, most widely distributed species of the genus. Specimens are at hand from Argentina, Paraguay, and Uruguay. Those from Paraguay come from Sapucay.

#### PARALEUAS Giglio-Tos.

The representatives of this genus are of small or medium size and, judging from the material before me, are fairly numerous. Like the species of *Jodacris* and *Onalotettix* they occur among the dead leaves and herbage growing beneath the larger shrubs and trees composing the forests and jungles which prevail over much of Paraguay and Brazil. The three forms at hand and *Paraleuas bohlsii* Giglio-Tos may be separated by the subjoined table.

## TABLE FOR DETERMINATION OF SPECIES.

- a. Larger (female, 23–26 mm.). Tegmina unicolorous, without maculations.
- b. Hind femora green, not provided with fuscous annulations externally. Hind tibiae green ..... *bohlsii* Giglio-Tos
- bb. Hind femora brunneo-testaceous and furnished externally with two fairly well-defined dusky bands, most prominent above. Tibiae deep glaucous, infuscated apically ..... *fosteri*, new species
- aa. Smaller (female 17.5–20 mm.). Tegmina rather evenly maculate with small fuscous spots.
- b. Hind femora banded with fuscous both internally and externally. Lower edge of cheeks, pronotum, and pleura not entirely pale (Paraguay).  
..... *punctipennis*, new species
- bb. Hind femora not banded with fuscous. The lower edge of cheeks, pronotum, and pleura pale banded (Victoria, Brazil) ..... *minor*, new species<sup>a</sup>

## PARALEUAS BOHLSII Giglio-Tos.

*Paraleuas bohlsii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XIII, 1898, No. 311, p. 57.

*Habitat*.—Reported from Paraguay by Giglio-Tos, but not represented in the material now at hand as a basis of this paper.

## PARALEUAS FOSTERI, new species.

Like *P. bohlsii* Giglio-Tos, the present species has the general appearance of a *Stenopola*. It is brunneo-ferruginous above, and is provided on the cheeks, lower part of sides of pronotum, and on the pleura with a pale band.

<sup>a</sup> While at Victoria, Brazil, several years ago the writer secured, among other material which he collected there, several specimens of a small locust which is related to the other species tabulated above. As species of the genus occur over a rather extended range and each may have an extensive distribution, it is thought wise to describe *P. minor* at this time.

As shown by the above table, it is most nearly related to the *A. punctipennis* which comes from San Bernardino, from which it differs, however, in its considerably smaller size, its somewhat general paler color, and in the presence of well-defined pale lateral bands on sides of head, lower portion of sides of pronotum, and pleura. While it is provided with the fuscous tegmina maculations, *minor* is without the dusky bands on the hind femora. In the present species the head of the male is very short and much broader than the front edge of the pronotum, and the tegmina and wings slightly surpass both the apex of the abdomen and the tips of the hind femora. The eyes are unusually large and prominent, so as to give to the head when viewed from in front the appearance of being nearly twice as broad above as below. The cheeks below the eyes are less than one-half as long as the greatest diameter of one of them. Hind tibiae colored as in *punctipennis*, with 8 spines in the outer row.

Length of body, male, 13, female, 17.5; of pronotum, male, 2.3, female, 2.8; of tegmina, male, 11, female, 12; of hind femora, male, 8.5, female, 9 mm.

*Habitat*.—Victoria, Brazil, during the month of May, both sexes. (Collection of L. Bruner.)

The present species does not have the second joint of the hind tarsi as nearly equal in length with the first as is the case in *punctipennis*.

Head moderately large, a little broader than the front edge of the pronotum, the occiput short; eyes large and prominent, much longer than that portion of the cheeks below them, separated above by a space scarcely as wide as the diameter of the basal joint of the antennæ; fastigium of the vertex horizontal, moderately large and broadly and very shallowly sulcate; frontal costa prominent above the ocellus where it is nearly twice as broad as the narrow vertex, plane, with a few coarse punctures, below the ocellas narrower, less prominent, sulcate and continuous to the clypeus. Antennæ rather coarsely filiform, a trifle longer than the head and pronotum together. Pronotum short, cylindrical, without lateral carinæ, strongly and coarsely impresso-punctate, a little expanding on posterior lobe. Tegmina narrow, about as long as abdomen and somewhat surpassing the apex of hind femora. The latter moderately broad at base, but flattened, slender apically. Hind tibiæ and tarsi rather profusely and longly hirsute, the former provided with 7 spines in outer row. Prosternal spine robust, short, and directed gently to the rear.

General color above brownish ferruginous, with a well-defined piceous band on the head back of eyes, on upper portion of sides of pronotum and pleura, followed below by a narrower one of flavous, which is again bordered on the lower margin by a darker color that continues to the pectus and venter. Sides of abdomen largely piceous. Tegmina brownish ferruginous, becoming fuliginous apically. Wings much infuscated. Hind femora ferrugineo-testaceous, with traces of two dusky bands across upper edge and black ones internally, the apex black internally on lower half, reddish on upper half, preceded by a pale annulus. Hind tibiæ dull plumbeous basally, becoming strongly infuscated apically. Antennæ ferruginous.

Length of body, female 23, of pronotum 3.8, of tegmina 16, of hind femora 10.5 mm.

*Type*.—Cat. No. 9739 U.S.N.M.

*Habitat*.—Sapucay, Paraguay, 5 females collected during the months of January and February (W. T. Foster).

**PARALEUAS PUNCTIPENNIS, new species.**

A somewhat smaller but more robust insect than the preceding and differing from it in lacking the decided pale band on sides of head, pronotum and pleura, in possessing a broader head, larger and more prominent eyes, a shorter pronotum and correspondingly shorter tegmina and wings. The tegmina in *punctipennis* are somewhat shorter than the abdomen and strongly mottled with fuscous, and the carinæ of the hind femora are conspicuously conspersed with black in addition to the darker outer face and much more pronounced fuscous bands. The disk of the pronotum and occiput is dirty gray, more or less conspersed and mottled with fuscous, as is also the face. The

eyes are brunneo-testaceous and aeneous in certain lights. Hind tibiae grayish plumbeous, a little darker apically. Anterior and middle legs conspersed with fuscous. Legs, venter and apical parts of abdomen strongly hirsute. Second joint of hind tarsi nearly as long as first.

Length of body, female 20, of pronotum 3, of tegmina 13, of hind femora 10 mm.

*Habitat*.—San Bernardino, Paraguay.

*Type*.—A single female taken by the writer in September.

This insect approaches *Bucephalacris* in some respects, but the prevailing characters are those of *Paraleuas*.

#### ORTHOSCAPHEUS, new genus.

According to Giglio-Tos' table for the separation of the described genera of South American Acridiinae<sup>a</sup> the insect upon which the present genus is based would run to *Joducris*. The peculiar structure of the ovipositor, as compared with that of *J. ferruginea*, will, however, separate it from that genus, as will also several other characters. Face, pronotum, and pleura strongly punctate. Female front subvertical, very slightly advanced between the antennae when viewed laterally; frontal costa very broad and fairly prominent above the ocellus, where it is without sulcation and nearly impunctate, at and below the ocellus a little narrower, sulcate and continuous to the clypeus. Eyes fairly prominent, a little longer than the cheeks below them, front edge nearly straight, the back side broadly rounded; vertex between the eyes about as broad as the basal antennal joint, the fastigium broadly triangular, its front edges meeting in an obtuse angle, narrowly and shallowly sulcate in the middle. Antennae presumably filiform (the only specimen at hand is without them). Pronotum profusely and strongly punctate, with the sides of anterior lobe parallel, the posterior one expanding, the two lobes of about equal length, the hind sulcus profound; front boarder broadly rounded the center shallowly emarginate, hind border obtusangulate; median carina distinct in front and on the hind lobe; sides a little higher than long, the edges nearly parallel, lower posterior angle square, the apex a little rounded, the anterior angle obliquely truncate. Tegmina complete, coriaceous, profusely and strongly veined, a little tapering, the apex rounded, and the costal field near the base rather strongly ampliate. Hind femora moderately robust, the pinnae quite regular, their tips not quite reaching the apex of the abdomen, the genicular lobes rounded. Overpositor long and straight, the upper valves without teeth, of nearly equal width throughout, their apices bluntly rounded; the lower ones smaller, shorter, and more slender, tapering and acuminate, in a measure lying between the lower edges of the upper pair.

<sup>a</sup> Boll. Mus. Zool. Anat. Comp. Uni. Torino, 1898, No. 311, pp. 40-50.

Mesosternal lobes separated by a subquadrate space about equal in width to the lobes themselves. Prosternal spine pyramidal, moderately robust and directed gently to the rear.

*Type of genus.*—*Orthoscapheus roseipennis*.

**ORTHOSCAPHEUS ROSEIPENNIS, new species.**

? *Osmilia coriacea* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX 1894, No. 184, p. 18.

General color, dark wood-brown, with some indication of ferruginous upon head, pleura and hind femora. Tegmina quite evenly conspersed with small fuscous spots. Frontal costa above the ocellus black; the hind femora with the inner side, lower sulcus and the lower outer edge also pitch black; upper edge with two transverse dusky bands, the outer fourth including knee brownish testaceous. Surface of head, pronotum, pleura, anterior and middle legs, and carinæ of hind femora also conspersed with dark brown or black. Hind wings beautiful, transparent rose color, becoming smoky apically, the veinlets on apical half and some of the veins also black, the remainder rose-red.

Length of body, female 28.5, of pronotum 5.5, of tegmina 23, of hind femora 14, of ovipositor 2.65 mm.

*Type.*—Cat. No. 9740, U.S.N.M.

*Habitat.*—Sapucay, Paraguay, a single female specimen, which was taken February 28 by W. T. Foster. It may be taken as the type of the genus.

The *Osmilia coriacea* Giglio-Tos, may be identical with this insect, and, if so, his name would have priority, and it should be *Orthoscapheus coriaceus* Giglio-Tos.

**JODACRIS Giglio-Tos.**

**JODACRIS FERRUGINEA Giglio-Tos.**

*Anniceris ferrugineus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 30, in part.

*Jodacris ferruginea* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, No. 302, pp. 32-33, footnote (1897) in part.

*Habitat.*—Province of San Pedro, Paraguay (Giglio-Tos); Sapucay, W. T. Foster, several specimens (Coll. U.S.N.M.); San Bernardino (L. Bruner).

For a straightening out of the synonymy of this insect see remarks under *Omalotettix*.

**OMALOTETTIX, new genus.**

Related to *Jodacris* and *Orthoscapheus*, but differing from both of these in the more compressed body; from *Jodacris* by the great disparity in size between the sexes and in the shorter male cerci, which have the two forks more nearly equal. It differs further from this

last-named genus by having the hind femora slenderer apically, the vertex between the eyes narrower, and the hind lobe of the pronotum longer and more ampliate, as well as angulate instead of broadly rounded.

In his diagnosis of the genus *Jodacris*<sup>a</sup> it is evident that the author had before him specimens of two distinct genera—a male of his *ferruginea* and a female of the *Jodacris* (?) *nebulosa* Bruner.<sup>b</sup> This genus is widely distributed over tropical America and contains several species. These inconspicuously colored insects live in forests, where they occur among fallen leaves and on the stems of plants. Three species are known to abound in Paraguay. They may be separated by the subjoined synoptic table.

This last-named insect may be considered the type of *Omalotettix*.

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Paler, testaceous to brunneo-testaceous. Outer lower edge of hind femora largely black, the sides of pronotum usually provided with a piceous band which is bordered above and below by one of paler hue.
- b. Larger (male, 17; female, 21 mm.). Hind femora with two dusky bands across the upper edge, the outer face plain ..... *nebulosa* Bruner
- bb. Smaller (male, 14; female, 19 mm.). Hind femora provided on outer face with a conspicuous black patch ..... *signatipes*, new species
- aa. Darker, wood-brown to brunneo-ferruginous. Outer lower edge of hind femora without the black color. Sides of pronotum unicolorous.

*cæruleipennis* Bruner

#### OMALOTETTIX NEBULOSA Bruner.

*Jodacris* (?) *nebulosa* BRUNER, Locusts of Argentina, 1900, p. 67.

*Habitat*.—Sapucay, Paraguay, 4 males and 12 females (W. T. Foster); Tucuman, Argentina, and Victoria, Brazil (L. Bruner).

As mentioned above, this insect was confounded with *Jodacris ferruginea* by Giglio-Tos when he drew up his diagnosis of the genus. He also credits it to Paraguay.

#### OMALOTETTIX SIGNATIPES, new species.

Very similar to the preceding, from which it differs in the points indicated in the synoptic table of species given above. It also differs from *nebulosa* in having a slightly shorter and broader fastigium of the vertex, a slightly less prominent frontal costa between the base of the antennæ and a little shorter hind lobè of the pronotum, which is less decidedly angulate.

Length of body, males, 14; females, 19; of pronotum, males, 3; females, 4; of tegmina, males, 13; females, 18; of hind femora, males, 8.5; females, 12 mm.

*Type*.—Cat. No. 9741, U.S.N.M.

<sup>a</sup> Boll. Mus. Zool. Anat. Torino, 1897, No. 302, pp. 32-33.

<sup>b</sup> Locusts of Argentina, 1900, p. 67.

*Habitat*.—Sapucay, Paraguay, 2 females collected in March by W. T. Foster.

There are also a number of specimens of both sexes of this species in the writer's collection from Pernambuco, Brazil, and Temax, Yucatan.

**OMALOTETTIX CÆRULEIPENNIS** Bruner.

*Jodacris* (?) *cæruleipennis* BRUNER, Locusts of Argentina, 1900, p. 68.

*Habitat*.—Three males and 4 females, Sapucay, Paraguay (W. T. Foster); other specimens at Asuncion (L. Bruner).

This species also occurs in northern Argentina, where it may be taken in company with *nebulosa*. It appears less common than the other two species here mentioned.

**VILERNA** Stål.

**VILERNA RUGULOSA** Stål.

*Vilerna rugulosa* STÅL, Syst. Acrid., 1878, p. 61.

*Habitat*.—Sapucay, 1 specimen, W. T. Foster collector; San Bernardino and Asuncion, L. Bruner collector; province of San Pedro, Luque, and Asuncion, Paraguay, Giglio-Tos.

This insect is fairly common and should be sought for among the yucca and pineapple-like plants, in the center and about the base of the leaves of which it lurks and where it is more or less thoroughly protected from lizard and bird enemies.

**OSMILIOLA** Giglio-Tos.

**OSMILIOLA AURITA** Giglio-Tos.

*Osmiliola aurita* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 33.

*Habitat*.—This insect was described from specimens collected at San Lorenzo, in the province of Jujuy, Argentina, and Caiza, in the Bolivian Chaco. A single female specimen at hand was taken at Pernambuco, Brazil. It evidently occurs in Paraguay also.

**XIPHIOLA** Bolivar.

**XIPHIOLA BORELLII** Giglio-Tos.

*Xiphiola borellii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XV, 1900, No. 377, p. 5.

*Habitat*.—There are 3 males and 2 females before me from Sapucay. They were collected by W. T. Foster. The type came from Urucum, Brazil.

## SCHISTOCERCA Stål.

## TABLE FOR DETERMINATION OF SPECIES.

- a. Pronotum with its posterior edge decidedly angulate. Antennæ of male nearly or quite one-half longer than the pronotum.
  - b. Tegmina distinctly maculate. Sides of pronotum with the lower area obliquely pale, edged above with fuscous. Male cerci apically narrowed.
    - desiliens* Scudder
  - bb. Tegmina immaculate or very faintly maculate; the lower area of sides of pronotum pale yellow, separated obliquely from the darker upper portion. Male cerci but little narrowed apically.
    - c. Antennæ of male one-half as long again as the head and pronotum together. Wings feebly infumate; the tegmina feebly or obscurely maculate.
      - flavofasciata* (De Geer)
    - cc. Antennæ of male one-third as long again as the head and pronotum together. Wings strongly infumate, the tegmina immaculate. .... *infumata* Scudder
  - aa. Pronotum with its posterior edge distinctly rounded. Antennæ of male relatively shorter.
    - b. Head unusually large, broader than the front edge of the pronotum, giving to the insect a strangulate appearance.
      - c. General color bright olive green, salmon, and cream, the tegmina obscurely if at all maculate. The pronotum coarsely granulate and with the anterior lobe plainly tectate. .... *lineata* (Stoll)
      - cc. General color testaceous, ferruginous, and white, the tegmina plainly, often strongly, maculate. The pronotum finely granulate, in nowise tectate.
        - d. Pronotum very decidedly strangulate on anterior lobe; the maculation of tegmina rather evenly distributed, the anal area at broadest point one-third broader than the interspace between the eyes. .... *peregrina* (Olivier)
        - dd. Pronotum less decidedly strangulate; the maculation of tegmina inclining to form bands, the anal area at its broadest point no broader or but little broader than the interspace between the eyes.
          - paranensis* (Burmeister)
      - bb. Head normal, about as wide as the front edge of the pronotum. Maculations of tegmina confined chiefly to the middle area and gathered into two longitudinal rows on apical third ..... *pallens* (Thunberg)

## SCHISTOCERCA DESILIENS Scudder.

*Schistocerca desiliens* SCUDDER, Proc. Amer. Acad. Arts Sci., XXXIV, 1899, p. 455.

*Habitat*.—Specimens of this species were observed by the writer in the vicinity of Asuncion, in 1897. There are none in the collections at hand from Paraguay, but quite a series are before me from Victoria, Brazil.

## SCHISTOCERCA FLAVOFASCIATA (De Geer).

*Acrydium flavofasciatum* DE GEER, Mém. Ins., III, 1873, p. 488, pl. XL, fig. 8; for additional synonymy see Scudder's Orthopteren Genus Schistocerca.

*Habitat*.—Reported from Asuncion and Luque, Paraguay. Not represented in the collection just studied.

**SCHISTOCERCA INFUMATA** Scudder.

*Schistocerca infumata* SCUDDER, Proc. Amer. Acad. Arts Sci., XXXIV, 1899, p. 457.

*Habitat*.—Sapucay, Paraguay, 8 males and 6 females, collected by W. T. Foster. Also reported from Paraguay by Jas. A. G. Rehn.

This rather fine appearing locust is quite generally distributed over Argentina and Uruguay along the La Plata River and northward into Brazil at least as far as Pernambuco, where two specimens of it were observed by the writer at the edge of a swamp.

**SCHISTOCERCA LINEATA** (Stoll)?

*Gryllus (Locusta) lineatus* STOLL, Rep. Spect., etc., 1787, p. 31, pl. xv, fig. 57.

*Habitat*.—The writer has before him 4 male and 4 female specimens of a *Schistocerca* that might be the insect figured by Stoll. It is quite distinct in its coloration from every other form ever examined by me. It comes from Sao Paulo, Brazil, where it seems to be fairly common. Should the present determination be correct, the name of Scudder's *lineata* must be changed. I would suggest the name *scudderi* as a suitable one.

**SCHISTOCERCA PALLENS** (Thunberg).

*Gryllus pallens* THUNBERG, Mém. Acad. St. Petersb., V, 1815, p. 237. For further synonymy see Scudder.

*Habitat*.—Not represented in the collections at hand. It is known, however, to be pretty widely distributed over tropical America from Mexico to the Uruguay River. It certainly occurs in Paraguay.

**SCHISTOCERCA PARANENSIS** (Burmeister).

Plate XXXVII, fig. 4.

*Acridium paranense* BURMEISTER, Reis. La Plata Stat., I, 1861, p. 491.

*Schistocerca paranensis* BRUNER, 1st Rept. B. A. Loc. Com., 1898, pl., figs. 1-3, 6.

*Acridium (Schistocerca) peregrinum* (part) BERG, Anal. Soc. Cient. Argent., IX, 1880, p. 275.

*Habitat*.—This migratory species reaches Paraguay regularly in its annual flights if it is not permanently found in some portion of the country. It was observed in great abundance in the vicinity of Asuncion during 1897, when the writer made a visit to that region.

**SCHISTOCERCA PEREGRINA** (Olivier).

*Acridium peregrinum* OLIVIER, Voy. Emp. Ott., II, 1807, p. 424. For additional synonymy see Scudder.

*Habitat*.—While this insect is chiefly confined to the Mediterranean region of the Orient, it is frequently reported from various parts of tropical America. Giglio-Tos records it as coming from various Paraguayan, northern Argentinian, and southern Brazilian points. Evi-

dently many of these reports are based on specimens of the preceding species. I myself have seen no typical specimens of *peregrina* that were taken on this side of the Atlantic.

# ATRACHELACRIS Giglio-Tos.

## ATRACHELACRIS UNICOLOR Giglio-Tos.

Plate XXXVIII, fig. 8, female; fig. 9, male.

*Atrachelacris unicolor* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 21.

*Habitat*.—Several specimens of the two sexes from Sapucay, Paraguay, are before me. They were collected by W. T. Foster. It is also reported from Asuncion by Giglio-Tos.

## DICHROPLUS Stål.

Many of the insects which comprise this extensive genus are very closely related to one another in their general appearance, and the comparatively few forms that have thus far been noted by entomologists have been so briefly described that it is a little doubtful as to the identity of all of them. This is especially true when the student is limited in the material that is accessible for study. With comparatively few exceptions the members of the genus are confined to regions south of the equator in South America, with Paraguay and northern Argentina as the center of their distribution. This being true, most of the species may be expected to occur in the country now under consideration. The subjoined table will be of assistance in determining them.

### TABLE FOR DETERMINATION OF SPECIES.

- a. Female with the valves of the ovipositor emarginately truncate. Interval between the mesosternal lobes considerably longer than wide. Male cerci moderately long, compressed back of middle, beyond gently bowed.
- b. Prosternal tubercle large, transverse. Lower edge and inner face of hind femora blood-red. General color dull brown.....*obscurus* Bruner
- bb. Prosternal tubercle not large, conical. Lower edge and inner face of hind femora yellowish.
- c. Smaller. General color olivaceous yellow. Upper valves of ovipositor much longer than the lower ones .....*clians* Stål
- cc. Larger. General color brownish yellow. Upper valves of ovipositor but little longer than lower ones.....*lemniscatus* (Stål)
- aa. Female with the valves of the ovipositor entire at apex, acuminate or subacuminate. Interval between the mesosternal lobes usually, but not always, as broad or a little broader than long.
- b. Hind tibiae with nine spines in outer row. Tegmina and wings usually, but not always, reaching or surpassing the tip of abdomen.
- c. Interval between the mesosternal lobes a little longer than wide. Upper edge of sides of pronotum generally dusky throughout, but sometimes only to the posterior sulcus.
- d. Tegmina not or scarcely surpassing the tip of hind femora.

- e. Frontal costa sulcate.
- f. Posterior coxæ marked externally with a dark line.
  - g. Disk of tegmina dark veined.....*fuscus* (Thunberg)
  - gg. Disk of tegmina not dark veined. Lower sulcus and inner face of hind femora red.....*cinereus* Bruner
- ff. Posterior coxæ not marked externally with a dark line.
  - g. Smaller. Green and yellowish, hind femora on basal half internally sanguineous. Tegmina unicolorous, sordid yellow.
    - bicolor* Giglio-Tos
  - gg. Larger. Brownish testaceous, the hind femora internally flavous. Tegmina faintly conspersed with fuscous.
  - h. Very robust. Hind femora incrassate and with the lower outer sulcus infuscated, surpassing the tip of tegmina and abdomen in the female.....*robustus*, new species.
  - hh. Less robust. Hind femora normal, the lower outer sulcus concolorous, about reaching or falling a little short of the tip of tegmina and abdomen in the female.
    - paraguayensis*, new species
- ee. Frontal costa not sulcate. Dorsal edge of tegmina pale-veined.
  - patruelis* Stål
- dd. Tegmina surpassing the tip of hind femora.
  - e. Male cerci rather heavy and straight. Lower sulcus of hind femora yellowish.....*pratensis* Bruner
  - ee. Male cerci slender, incurved beyond the middle. Lower sulcus of hind femora orange-red.
    - f. Smaller, very slender; the sides of pronotum parallel. Dusky band on side of pronotum extending to metapleura.....*exilis* Giglio-Tos
    - ff. Larger, less graceful; the sides of pronotum diverging posteriorly. Dusky band on side of pronotum continued upon tegmina to the apex.....*elongatus* Giglio-Tos
- cc. Interval between mesosternal lobes fully as wide or wider than long. The dusky band on sides of pronotum more or less interrupted.
  - d. Posterior lobe of pronotum somewhat ascending posteriorly, a little longer than the anterior lobe.....*arrogans* Stål
  - dd. Posterior lobe of pronotum not ascending posteriorly, about equaling or a trifle shorter than the anterior lobe.
    - e. Posterior coxæ fuscous or black spotted. Last ventral segment of male abdomen with the lateral margins black.
    - f. Smaller. Hind tibiae red.....*punctulatus* (Thunberg)
    - ff. Larger. Hind tibiae greenish testaceous.....*conspersus* Bruner
  - ee. Posterior coxæ unspotted. Last ventral segment of male abdomen with the margins never black.
    - f. Hind femora with the inner face and lower sulcus flavous or testaceous. Tegmina rather evenly and finely conspersed with fuscous.
      - dubius*, new species
    - ff. Hind femora with the inner face and lower sulcus, at least in part, sanguineous. Tegmina abbreviate or fully developed, not evenly conspersed with fuscous.
    - g. Hind tibiae deep purple. Pronotum at sides of disk pale vittate.
      - brasilienis*, new species
    - gg. Hind tibiae glaucous. Disk of pronotum either vittate or concolorous.
    - h. Tegmina and wings usually greatly abbreviated. Sides of disk of pronotum and dorsal angles of tegmina pale vittate.
      - vittatus* Bruner

- hh. Tegmina not abbreviated, nearly or quite as long as the abdomen.  
Pronotum and tegmina not vittate.
- i. General color, dull olivaceous yellow or testaceous.
- j. Lower edges of sides of pronotum dirty white. Tegmina not conspersed ..... *bergii* Stål
- jj. Lower edges of sides of pronotum concolorous. Tegmina conspersed with small fuscous dots ..... *robustulus* Stål
- ii. General color, fusco-ferruginous. Inferior portion of sides of pronotum sordid testaceous ..... *distinguendus* Giglio-Tos
- bb. Hind tibiæ provided with eight spines in the outer row. The tegmina usually, but not always, abbreviated.
- c. Tegmina fully developed, reaching or even surpassing the apex of the abdomen and tips of hind femora. Hind femora internally fasciate with black; the tibiæ infuscated with a subbasal pale annulus .... *cinctipes*, new species
- cc. Tegmina and wings abbreviated, about as long as the head and pronotum united. Hind femora internally largely sanguineous.
- d. Hind tibiæ red ..... *peruvianus* Stål
- dd. Hind tibiæ glaucous.
- e. Larger. Apex of femora wholly and base of hind tibiæ black. .... *amænus* Stål
- ee. Smaller. Apex of hind femora for most part olivaceous, the base of hind tibiæ glaucous. Outer face of hind femora with upper half fuscous, the lower half dirty white, inside and below sanguineous. .... *schulzi*, Bruner

#### DICHIROPLUS LEMNISCATUS (Stål).

*Acridium* (*Podisma*) *lemniscatum* STÅL, Freg. Eugene Resa, Ins. Orthopt., 1860, p. 334.

*Habitat*.—Not contained in the collections at hand. Previously reported from Argentina and Brazil. No doubt also to be found in Paraguay.

#### DICHIROPLUS FUSCUS (Thunberg).

*Gryllus fuscus* THUNBERG, Mém. Acad. St. Petersb., V, 1815, p. 235.

*Pezoletix* (*Trigonophymus*) *fuscus* STÅL, Recens. Orthopt., I, 1873, p. 78.

*Dichroplus fuscus*, GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 21.

*Habitat*.—Not contained in the collections at hand, but reported from Resistencia, Argentinian Chaco, and also from the Bolivian Chaco by Giglio-Tos. It certainly also crosses over the river into Paraguay.

#### DICHIROPLUS BICOLOR Giglio-Tos.

*Dichroplus bicolor* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 21.

*Habitat*.—Recorded from Asuncion, Paraguay, by Giglio-Tos; also from northern Argentina and Bolivia. Not represented in the collections at hand.

#### DICHIROPLUS ROBUSTUS, new species.

A large robust species related to *D. cinctipes* and *D. paraguayensis*, but differing from both of them in several particulars, as will be seen from an examination of the accompanying synoptic table. As compared

with *cinctipes*, the present species is much larger and lacks the decided dusky bands on the sides of the head back of the eyes and on the pronotum, and the hind femora only bear traces of the fuscous bands across their upper edge, while the hind tibiae are characterized by the entire absence of any fuscous tinge. The tegmina of *robusta* also lack the decided conspersing of the species to which it has just been compared. Its head is slightly narrower than the front edge of the pronotum and the eyes less prominent, while the latter gradually widens from the front edge instead of only on the posterior lobe. The tegmina and wings do not quite reach the tips of the robust hind femora.

General color uniform pale brownish testaceous, with a shade of olive on sides of pronotum, pleura, and outer face of hind femora; head and pronotum with a few scattered small dots of reddish brown; tegmina also dimly marked with small pale brownish specks, especially in the discal field and on dorsal edge of basal half; hind femora with their lower edge dark plumbeous, and a series of five medium-sized blotches of same color on lower outer carina, upper edge crossed by two well-defined, but not prominent, dusky bands, which cross over to the inner face and fade away; antennae fuscous, darkest at apex; prosternal spine rather long, coarse, and curved to the rear.

Length of body, female, 33; of pronotum, 7.5; of tegmina, 22; of hind femora, 18.5 mm.

*Type*.—Cat. No. 9742, U.S.N.M.

*Habitat*.—Sapucay, Paraguay; January. W. T. Foster, collector. Two females.

**DICHRPLUS PARAGUAYENSIS, new species.**

Size medium, form elongate, but not especially slender. General color uniform brownish testaceous or dull ferruginous with an olivaceous tinge on head, sides of pronotum, and hind femora, most apparent in the female, without indications of darker or lighter markings save at the base of the tegmina, where there is a trace of black on the median veins, and, faint indications of dusky bands on upper edge of hind femora. Middle of sides of pronotum also provided with the usual piceous band, but very faintly.

Body, legs, and even tegmina rather hirsute. Head a little wider than the front edge of the pronotum, the occiput slightly elevated above the level of pronotal disk, vertex between the eyes nearly twice the width of the first antennal joint, the fastigium depressed, broadly sulcate; frontal costa a trifle contracted above, evenly widening below, coarsely punctate above and sulcate at ocellus and below. Pronotum with the anterior lobe cylindrical, a little longer than the posterior one, which has the surface gently punctate and the hind margin a little obtuse angled, the apex rounded. Tegmina of medium width, a little surpassing the apex of both femora and abdomen. Hind femora rather

slender, a little surpassing the tip of abdomen; hind tibiae 9 spined in outer row. The last ventral segment of male abdomen elongate, with the upper edges straight and the apex bluntly rounded, directed posteriorly. Cerci slender, evenly tapering, fully three times as long as basal width, directed posteriorly and a little upwards, and bent inwards. Prosternal spine slender, acuminate.

Length of body, male, 23; of pronotum, 5.15; of tegmina, 18; of hind femora, 13 mm.

*Type*.—Cat. No. 9743, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, a single male specimen which seems to have lost its color by immersion in spirits or some other preservative. This insect seems to approach *D. bergii* Stål most closely in general structure.

#### DICHIROPLUS PATRUELIS Stål.

*Acridium* (*Podisma*) *patruelis* STÅL, Freg. Eugene Resa, Ins. Orthopt., 1870, p. 334.

*Pezotettix* (*Dichroplus*) *patruelis* STÅL, Recens. Orthopt., 1873, I, p. 78.

*Habitat*.—Reported by Giglio-Tos as occurring in the Province of San Pedro, Paraguay, and from Resistencia, Argentina. Not represented in the collections at hand.

#### DICHIROPLUS EXILIS Giglio-Tos.

*Dichroplus exilis* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 23.

*Habitat*.—This species is represented by both sexes from Sapucay, Paraguay, where they were taken by W. T. Foster. It is also reported from Paraguay by Rehn. Outside it is known from Resistencia and San Lorenzo in Argentina.

#### DICHIROPLUS ELONGATUS Giglio-Tos.

Plate XXXVI, fig. 10.

*Dichroplus elongatus* GIGLIO-TOS, Boll. Mus. Zool. Anat., Torino, IX, 1894, No. 184, p. 23.

*Habitat*.—Villa Rica and Asuncion, Paraguay (Giglio-Tos). Not represented in the collections studied for this paper. It is more common to the southward and westward.

#### DICHIROPLUS PUNCTULATUS (Thunberg).

Plate XXXVIII, figs. 3 and 4.

*Gryllus punctulatus* THUNBERG Mém. Acad. St. Petersb., IX, 1824, p. 408.

*Pezotettix* (*Trigonophymus*) *punctulatus* STÅL, Recens. Orthopt., I, 1873, p. 77.

*Pezotettix* (*Dichroplus*) *punctulatus* STÅL, Obs. Orthopt., III, 1878, p. 6.

*Habitat*.—This, the most widely distributed species of the genus, is represented by specimens collected at Sapucay by Mr. W. T. Foster. It occurs from middle Argentina to Central America and southern Mexico, and exhibits considerable variation in color and size.

**DICHIROPLUS CONSPERSUS** Bruner.

*Dichroplus conspersus* BRUNER, Locusts of Argentina, 1900, p. 76, fig. 4.

*Habitat*.—Not represented in the collections at hand, but it should be found in southern Paraguay where the country is open.

**DICHIROPLUS DUBIUS**, new species.

A rather robust, medium sized insect, the general color of which is brownish testaceous, paler beneath, conspersed on legs and tegmina with moderately large brownish or dull black flecks.

Head as wide as front edge of pronotum; eyes not prominent, their front edge straight, separated above by a space equal to one-half of their longest diameter; fastigium of vertex declivant, broad, hexagonal, bounded on sides by rather prominent carinæ, in front by a faint one and open behind; frontal costa fairly prominent and broad, a little widest at ocellus, flat and coarsely punctate above, broadly sulcate at ocellus and below. Pronotum rather broad, considerably widest on hind lobe, the anterior lobes a trifle the longest; transverse sulci deep, the middle and hind uninterrupted and reaching the lower lateral edges, the anterior one interrupted just below the dorsum; anterior edge truncate, behind obtusangulate the apex rounded. Tegmina tapering, their apex rounded, about as long as abdomen. Hind femora and tibiæ rather robust, the former as long as, or a little longer than, the abdomen, the latter with 9 spines on outer edge. Prosternal spine robust but evenly pyramidal; interspace between mesosternal lobes about as long as broad. Hind femora without definite transverse bands save as the dusky dots referred to above congregate into two patches on the upper edge; the bounding carinæ of outer disk regularly dark dotted; hind tibiæ brownish testaceous.

Length of body, male 17, female 20; of pronotum, male 4.35, female 5; of tegmina, male 15, female 14; of hind femora, male 11, female 13 mm.

*Type*.—Cat. No. 9744, U.S.N.M.

*Habitat*.—A number of females and 3 males from Sapucay, Paraguay, where they were collected by W. T. Foster.

**DICHIROPLUS BRASILIENSIS**, new species.

There are several specimens of an apparently undescribed species at hand that were taken by the writer during May, 1897, at Victoria, Brazil. They are about the size of *D. Bergii* Stål, and are to be distinguished from all other described species by their deep purple hind tibiæ. There is a possibility of this insect being found in Paraguay also.

**DICHOPLUS VITTATUS Bruner.**

*Dichroplus vittatus* BRUNER, Locusts of Argentina, 1900, p. 77, figs. 43 and 44.

*Habitat.*—Although not represented in the material at hand from Paraguay, it is sure to occur there when the country is a little more carefully explored.

**DICHOPLUS BERGII Stål.**

*Pezotettix* (*Dichroplus*) *bergii* STÅL, Obs. Orthopt., III, 1878, p. 6.

*Habitat.*—Various localities in Paraguay (Giglio-Tos, Rehn, Foster, Bruner). It is also found in other regions, as Uruguay, Brazil, Argentina, and Bolivia.

**DICHOPLUS ROBUSTULUS Stål.**

*Pezotettix* (*Dichroplus*) *robustus* STÅL, Obs. Orthopt., III, 1878, p. 7.

*Habitat.*—Not in the collections at hand, but very likely to be taken in Paraguay as well as in Brazil, from where it was described.

**DICHOPLUS DISTINGUENDUS Giglio-Tos.**

*Dichroplus distinguendus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 22.

*Habitat.*—Reported as occurring in the Province of San Pedro, Paraguay (Giglio-Tos). Not represented in the collections studied.

**DICHOPLUS CINCTIPES, new species.**

A medium-sized brownish testaceous insect with conspicuously banded hind femora. The two sexes not very unequal in size. Rather profusely hirsute on legs, abdomen, thorax, and even on the tegmina.

Head about as wide as the front edge of the pronotum; the eyes rather prominent, especially in the male, about as long (female) or a trifle longer (male) than the cheeks below them, in both sexes separated above by a space equal to the broadest part of the frontal costa; fastigium of the vertex broadly and shallowly sulcate, the bounding carinæ angulate and faintly separating it from the sulcus of the frontal costa; the latter quite prominent, especially between the base of the antennæ, a little narrowed above the antennæ, and again just below the ocellus continuous to the clypeus, sulcate throughout, more deeply in the male, and provided with strong, smooth, lateral carinæ; facial carinæ also prominent, in the male parallel, in the female very slightly sinuate and divergent below. Antennæ filiform, about as long (female) or a little longer (male) than the head and pronotum together. Pronotum with the sides of the anterior lobe cylindrical, smooth, the hind lobe strongly expanding posteriorly, punctate, the two lobes about equal in length; median carina present only on hind lobe; transverse sulci profound, continuous; anterior edge straight or very

slightly advanced upon the occiput, the hind margin obtusangulate, the apex broadly rounded. Tegmina rather narrow, tapering, about equaling (female) or a little surpassing (male) the tip of the abdomen. Hind femora only moderately robust, just reaching the tip of the male abdomen, but not quite that of the female. Hind tibiae normally provided with eight spines in outer row. Space between the mesosternal lobes about as long as broad, possibly a trifle broader than long in the female. Prosternal spine pyramidal, about as long as extreme basal width, the apex acuminate. Male cerci slender, tapering, and curved slightly downward toward the tip. Last ventral segment short, its upper edges straight and meeting behind in an acute angle.

General color above brownish testaceous, below paler, more or less conspersed with brown and black. The usual piceous band extending from the hind edge of eyes along the upper half of sides of pronotum to last transverse sulcus, somewhat interrupted in the female; below this the sides of pronotum and cheeks are pale testaceous, as are also oblique bands on both the meso- and metapleura. Antennae pale ferruginous. Pronotum above and tegmina inconspicuously conspersed with brown, the latter with a discal row of rather well-defined fuscous spots, the apical half membranous and semipellucid. Hind femora decidedly banded with fuscous externally and above; internally and below with black and pale testaceous; hind tibiae more or less testaceous and dusky, with a pale basal annulus. The three basal abdominal segments largely black.

Length of body, male, 21; female, 25; of antennae, male and female, 10; of pronotum, male, 4.6; female, 6; of tegmina, male, 15.5; female, 17.25; of hind femora, male 11; female, 14 mm.

*Type*.—Cat. No. 9745 U.S.N.M.

*Habitat*.—Sapucay, Paraguay, February, collected by W. T. Foster. Male and female specimens.

#### LEIOTETTIX, new genus.

Related to both *Dichroplus* and *Scotussa*, but differing from the former in the more cylindrical pronotum with its comparatively shorter hind lobe and in the more ampliate fastigium of the vertex; and from the latter in having the valves of the ovipositor normal instead of straight, and the cerci obliquely docked instead of broadly spatulate. The representatives of the genus are small or medium sized.

Body with the surface glabrous, hirsute. Head large, fully as wide as or even a little broader than the front edge of the pronotum. Eyes a trifle prominent, about as long (female) or somewhat longer (male) than the cheeks below them, separated above by a space equal to the greatest width of the frontal costa in the male and a very little

more in the female. Vertex in front of the eyes amplified and roundly depressed, the sulcation wide and with its lateral walls broadly angulate. Frontal costa broadest and most prominent between the antennæ, a very little narrowed above, broadly sulcate in the vicinity of the ocellus at least, and coarsely punctate above. Antennæ normal. Pronotum cylindrical, a very little compressed in middle, the transverse sulci all equally plain, the last plainly behind the middle; anterior lobe glabrous at sides, somewhat transversely rugose above, hind lobe coarsely and closely punctate. Tegmina complete, sparsely veined, a very little surpassing the apex of abdomen. Hind femora moderately robust, about the same length as the abdomen in the two sexes. Space between the mesosternal lobes longer than wide, narrower than the lobes themselves. Prosternal spine acute.

The four species of *Leiotettix* before me as I write all agree in having the dark bands back of eyes and along the sides of pronotum green or greenish instead of piceous or fuscous. These species may be separated by the annexed synoptic table:

The species *viridis* may be considered as the type of the genus.

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Size smaller (17 mm. male to 25 mm. female). The hind tibiæ green or glaucous.
- b. General color of insects above grass green, below testaceous. . . . .*viridis*, new species
- bb. General color of insect above cinereous.
- c. Sides of pronotum with scarcely any trace of darker band. Hind femora conspicuously conspersed with dark brown and black, their inner face testaceous . . . . .*punctipes*, new species
- cc. Sides of pronotum with a conspicuous band. Hind femora not conspersed externally, their inner side and lower sulcus blood-red. . . . .*sanguineus*, new species
- aa. Larger (23 mm. male, 28 mm. female). The hind tibiæ yellow or testaceous. . . . .*flavipes*, new species

#### LEIOTETTIX VIRIDIS, new species.

A medium-sized, grass-green, locust that at first sight reminds one of a small *Atrachelacris unicolor*, Giglio-Tos, but which upon a little closer examination is readily observed to be quite distinct.

Head rather large, fully as wide (female) or even a little wider (male) than the front edge of the pronotum; the eyes fairly prominent, fully as far apart above as the width of the frontal costa between the base of the antennæ; fastigium of the vertex roundly depressed, the lateral carinæ broadly angulate, in some specimens meeting in front and separating the sulcation of this part from that of the costa by a faint ridge; frontal costa quite broad, widest above the ocellus and between the antennæ, sulcate, fading away below before reaching the clypeus. Facial carinæ but little divergent below, fairly prominent. Pronotum glabrous, short, subcylindrical, a little contracted in the middle, nearly

(female) or quite (male) as wide in front as behind, the front edge broadly rounded, the hind margin obtusangulate, median carina prominent on hind lobe, obliterated on front lobe, the latter considerably the longer. Tegmina semimembranous, sparsely veined, a little surpassing both the abdomen and hind femora in the two sexes, the costal area rather prominently dilated on basal third. Hind femora rather robust, fully as long in the male or even a trifle surpassing the tip of the abdomen in the female. Hind tibiae 8 or 9 spined in outer row. Male cerci long, slender, the apical half bent inward and curved downward, somewhat lamellate and sulcate on outer face, the extreme tip obliquely docked.

General color as mentioned above, grass-green, the sides of pronotum a little darker where the piceous band usually occurs. Hind femora green above and on upper half of outer face, remainder yellow or testaceous save the genicular lunules which are dark piceous or black and a row of similarly colored spots on the lower carina of outer face. Hind tibiae greenish glaucous. Antennae testaceous, apically infuscated. Venter pale, the sides of basal segments of abdomen a little obscured near their anterior edge.

Length of body, male, 19, female, 23; of pronotum, male, 4, female, 5; of tegmina, male, 15, female, 16.5; of hind femora, male, 10.5, female, 13.6 mm.

*Type*.—Cat. No. 9746, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, in February, where both sexes were taken by W. T. Foster.

#### LEIOTETRIX PUNCTIPES, new species.

In size and general form quite similar to *L. viridis* which is described above, but differing from it in having slightly less prominent eyes, a somewhat more coarsely punctate and angulate pronotum, and more closely vined tegmina. The color of *punctipes* is cinereo-testaceous or cinereo-ferruginous above, flavous beneath, with a trace of the usual pronotal bands and alternate pale and darker meso- and meta plural stripes. The hind femora have all the upper and outer carinae, as well as the pinnae, conspersed with black or piceous, and the genicular lunules are dark only on the bounding carinae; hind tibiae cinereo-glaucous, a little varied with brown near base. Sides of basal abdominal segments conspicuously piceous on their anterior half.

Length of body, female, 23; of pronotum, 5.15; of tegmina, 18; of hind femora, 13 mm.

*Type*.—Cat. No. 9747, U.S.N.M.

*Habitat*.—In the same region and along with the preceding species. Also collected by W. T. Foster, 5 females.

**LEIOTETTIX SANGUINEUS**, new species.

A slenderer insect than either *viridis* or *punctipes*, but to both of which it is rather closely related. Its determinate characters are well defined dark green pronotal stripes and deep blood-red inside and lower edge of hind femora. The sides of face below the eyes and lower half of sides of pronotum are flavous, as are also a portion of the pleura, venter, and lower part of outer face of hind femora. Above, the general color is ferruginous, in some specimens with an olivaceous tinge near the base of tegmina. Costal field of latter olivaceous, as are the anterior and middle legs, along with the outer disk of the hind femora, the latter without dusky spots on the carinae, as described in *punctipes*. The hind tibiae deep glaucous. Male cerci similar to those of *viridis*. Sides of the four basal abdominal segments largely jet black. Median carina of pronotum plain throughout.

Length of body, male, 18, female, 25; of pronotum, male, 4, female, 5; of tegmina, male, 14, female, 16-18; of hind femora, male, 9.5, female, 13 mm.

*Type*.—Cat. No. 9748, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, January to March, 2 males and 2 females. Taken by W. T. Foster.

**LEIOTETTIX FLAVIPES**, new species.

In general structure and appearance quite similar to the other species of the genus described above, but differing from all of them in the larger size and the more decided dark pronotal bands. It also reminds one of the species of *Scotussa*, but it lacks the pale dorsal vittæ of both *S. rubripes* and *S. brasiliensis*, to which it approaches in size. As compared with them it has the head larger, the occiput shorter, the vertex broader and less deeply sulcate, the eyes less elongate and pointed above, the frontal costa broader above and more uniform in width, as well as decidedly sulcate in the vicinity of the ocellus. The pronotum is slightly contracted at the middle and the head is a trifle wider than its front edge—the sculpturing, punctuation, and arrangement of the sulci are the same, only the present species lacks the piceous bands on head and sides of pronotum back of the eyes, and in their stead has them deep green in color. The color of tegmina, body, and legs are similar, save that in the insect now under consideration the hind tibiae are testaceous instead of green or coral-red. In some specimens the lower sulcus and inner face of the hind femora lack the bright red of *brasiliensis* especially.

Length of body, male, 24, female, 28-31; of pronotum, male, 4.85, female, 6-6.5; of tegmina, male, 19, female, 20-21; of hind femora, male, 12.25, female, 15.25-16 mm.

*Type*.—Cat. No. 9749, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, 2 females (Coll. L. Bruner); a number of specimens of both sexes (Coll. U. S. Nat. Mus.).

In size and general appearance this insect reminds one very much of a representative of *Scotussa*, but the form of the ovipositor in the female and the cerci of the male are abnormal for that genus and come much nearer to those of *Leiotettix*.

SCOTUSSA Giglio-Tos.

SCOTUSSA IMPUDICA Giglio-Tos.

*Scotussa impudica* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 25, fig. 4 a, b, c.

*Habitat*.—Luque, Paraguay (Giglio-Tos). Not represented in the Paraguayan collections studied. It occurs also in Argentina as far south as the southern part of the province of Santa Fe.

SCOTUSSA RUBRIPES, new species.

General color olive-green, becoming rufous on disk of pronotum and on the tegmina; below greenish yellow. Cheeks and lower half of lateral lobes of pronotum pale greenish yellow. The latter, together with sides of head back of eyes, piceous; this piceous band bordered above by a narrow one of testaceous, which gives to the insect a bivittate appearance, and at first glance suggests a species of *Melanoplus* or *Dichroplus*, to which the present genus is closely related, but from which it is readily separated by the structure of the upper valves of the female ovipositor, which are unusually long, straight, and slender. Hind tibiae and tarsi bright coral-red.

Head about as wide as front edge of thorax, the face rather oblique viewed from the side, the occiput not elevated; width of vertex about two-thirds the shortest diameter of one of the eyes, fastigium gently depressed, sulcate, the well-defined bounding walls meeting in front at a right angle; frontal costa broad, narrowed to one-half its width at ocellus above where it is separated from the vertex by the meeting of the carinae that bound the sulcus, reaching the clypeus, not sulcate; eyes not prominent, about as long as the cheeks below them, slightly pointed above, straight in front; antennae filiform, about as long as head and pronotum together. Pronotum minus lateral carinae, with the anterior lobe cylindrical, the hind lobe slightly enlarging posteriorly, about two-thirds the length of the front one, transverse sulci dim, posterior edge broadly rounded or subangulate, surface of hind lobe profusely but shallowly punctate, of anterior one smoother. Tegmina and wings complete, reaching slightly beyond apex of hind femora and ovipositor, the tip rounded, intercalary vein well-defined, cross-veins and veinlets few except on basal fourth, where they are numerous and irregular, giving the member a granular appearance. Hind femora moderately robust, not quite reaching the apex of upper valves of ovipositor; hind tibiae with 8 spines in outer row. Proster-

nal spine moderately robust, pyramidal, directed gently to the rear. Valves of the ovipositor very unequal, the upper ones nearly twice as long as the lower, straight, and provided with several small saw-like teeth along their outer edge on apical half; lower valves weak and hooked at apex and furnished below with a single additional subapical tooth.

Length of body, female, 26; of pronotum, 6; of tegmina, 19; of hind femora, 13.5; of upper valves of ovipositor, 4 mm.

*Type*.—Cat. No. 9750, U.S.N.M.

*Habitat*.—A single female specimen from Sapucay, Paraguay.

The character of the ovipositor would indicate an abnormal egg-laying habit for this and allied species. Three such are known to me. They may be separated by the annexed

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Hind tibiae green or glaucous. Valves of ovipositor tapering, scarcely toothed.  
*impudica* Giglio-Tos
- aa. Hind tibiae coral-red. Valves of ovipositor of nearly equal size throughout, plainly serrate.
- b. Smaller (female, 26 mm.). Spines in outer row of hind tibiae 8. (Sapucay, Paraguay) ..... *rubripes*, new species
- bb. Larger (female, 31; male, 18 mm.). Spines in outer row of hind tibiae 9. (Sao Paulo, Brazil) ..... *brasiliensis*, new species<sup>a</sup>

#### PARASCOPAS, new name.

#### PARASCOPAS OBESUS (Giglio-Tos).

*Scopas obesus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Comp. Torino, IX, 1894, No. 184, p. 29.

Giglio-Tos proposed *Scopas* as the generic name for this insect. As it had been preoccupied by Bonapart for a fish genus I suggest that *Parascopas* be used for the locust, and that the species *obesus* Giglio-Tos be made the type of the genus.

The collection contains 5 specimens, 2 males and 3 females, from Sapucay (Coll. U. S. Nat. Mus.). There are also a pair, male and female, in the collection of L. Bruner. These latter bear the same label.

<sup>a</sup>Some time ago a considerable number of Orthoptera from southern Brazil was submitted to the writer for determination. Among these were 8 specimens of the insect here tabulated. Aside from being larger and more robust than *S. rubripes*, which is herewith described rather fully, this Brazilian species has the tegmina more densely veined and the pronotum somewhat expanding posteriorly throughout, as indicated by the diverging pale vittæ of the disk. The lower sulcus and inner face of hind femora are deep red, whereas in *rubripes* they are simply tinged with orange. As compared with *S. impudica* Giglio-Tos, *brasiliensis* has the two sexes greatly unequal in size, as will be seen by the following measurements:

Length of body, male, 18-20, female, 31; of pronotum, male, 4.75, female, 6.8; of tegmina, male, 16, female, 22; of hind femora, male, 11.5, female, 16 mm. Eight specimens, 4 males and 4 females.

## CHLORUS Giglio-Tos.

## CHLORUS BORELLII Giglio-Tos.

*Paradichroplus borellii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 27.

*Chlorus borellii* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XIII, 1898, No. 311, p. 50, note.

*Habitat.*—Asuncion, Paraguay (Giglio-Tos).

## CHLORUS VARICOLOR (Stål).

*Pezotettix varicolor* STÅL, Obs. Orthopt., III, 1878, p. 9.

*Paradichroplus varicolor* GIGLIO-TOS, Zool. Jahrb., VIII, p. 813.

*Chlorus varicolor* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XIII, 1898, No. 311, p. 50, note.

*Habitat.*—Giglio-Tos reports this insect as coming from Paraguay.<sup>a</sup> Possibly he refers to the insect which is described just beyond.

## CHLORUS VITTATUS, new species.

Dark brownish green, varied on head, pronotum and abdomen with dirty ochraceous. Sides of basal half of abdomen heavily marked with jet black. Body and limbs rather strongly hirsute.

Head rather large, a very little broader than the front edge of the pronotum, smooth; eyes large, rounded behind, nearly straight in front, separated above by a space about equal to the width of the frontal costa between the base of the antennæ, a little longer than the cheeks below them; fastigium of the vertex somewhat expanding in front, shallowly sulcate, roundly confluent with the upper end of facial costa; latter broad, prominent, a very little narrowed above, broadly and very gently sulcate near the ocellus, and strongly punctate on upper half. Antennæ filiform, about as long as the head and pronotum combined. Pronotum subcylindrical, somewhat expanding on hind lobe, without lateral carinæ, the median carina distinct throughout, slender, cut back of the middle by the last transverse sulcus, all three sulci quite strong; anterior edge truncate, faintly and broadly emarginate in middle, hind margin broadly rounded or subangulate. Tegmina broadly oval, rather coarsely veined, their dorsal edges not quite meeting, extending backward to near the middle of second abdominal segment. Hind femora robust, a little surpassing the tip of abdomen. Valves of ovipositor slender, pointed, the upper pair a trifle longer than the lower. Space between the mesosternal lobes a little narrower than the lobes themselves, a trifle widest anteriorly. Prosternal spine pyramidal, acute, directed a little to the rear.

As indicated above, the general color of this insect is dark brownish green, streaked and otherwise varied with dirty testaceous or ochra-

<sup>a</sup>See Zool. Jahrb., VIII, p. 813.

ceous. Head back of upper part of eyes and on each side of disk of pronotum provided with a line of medium width; face, cheeks below middle of eyes, lower half of sides of pronotum, and oblique lines on both meso- and metapleura ochraceous. Abdomen above also of this color. Tegmina dark, with paler veins, giving to them a ferruginous appearance. Hind femora very deep green, a little paler beneath; the hind tibiae dark blue-green, the tarsi testaceous. Antennae ferruginous, infuscated apically.

Length of body, female 27; of pronotum, 6; of tegmina, 5; of hind femora, 15 mm.

*Type*.—Cat. No. 9751, U.S.N.M.

*Habitat*.—Sapucay, Paraguay, January 9 and 10; 2 females; W. T. Foster, collector.

#### EUROTETRIX, new genus.

As indicted by the synopsis of the Melanopline genera of Paraguay, this genus is composed of brachypterous insects, the chief color of which is ferruginous. Related to *Chlorus* Giglio-Tos. Body and legs moderately hirsute.

Head large and broad, about as wide as the front edge of the pronotum; eyes large and prominent, nearly twice as long as the cheeks below them; vertex but little broader than the width of the basal antennal joint, the fastigium depressed and spatulately deeply sulcate; frontal costa fading before the clypeus. Antennae filiform, a little longer than the head and pronotum together. Pronotum with the anterior lobe cylindrical, the hind lobe considerably expanding, much shorter than the anterior; the transverse sulci quite distinct, front edge subtruncate, hind edge subangulate or broadly rounded. Tegmina greatly abbreviate, broadly ovate, their inner edges not quite touching. Hind femora large and robust, considerably surpassing the apex of the abdomen. Anterior and middle femora robust. The latter a very little enlarged apically, the last ventral segment short, entire at apex; supraanal plate scutellate, the cerci long, slender, pointed, and decurved at apex. Interspace between the mesosternal lobe nearly or quite as broad as long, but narrower than the lobes themselves. Prosternal spine broad at base, short, acuminate.

*Type of the genus*.—The species *femoratus* described herewith.

There are apparently two species of this genus at hand. They may be separated as follows:

#### TABLE FOR DETERMINATION OF SPECIES.

- a. Larger (male, 15.5 mm.). Hind femora very robust, without indications of dusky bands across their upper edge; their lower sulcus and tibiae deep purple.  
*femoratus*, new species
- aa. Smaller (male, 11 mm.). Hind femora less robust, their upper edge with two dusky bands, the lower sulcus scarlet; tibiae grayish-purple or lavender.  
*minor*, new species

**EUROTETRIX FEMORATUS, new species.**

A medium-sized brownish ferruginous locust with lobate tegmina and robust femora that greatly surpass the tip of the abdomen in the males.

Sides of head, back of eyes, and pronotum provided with a moderately broad piceous band that becomes much dimmer on the hind lobe. Lower half of lateral lobes of pronotum, together with the front edge and an oblique line running to base of hind femora testaceous. Tegmina uniformly dark brown. Sides of basal abdominal segments largely piceous. Hind femora above and externally ferrugineo-testaceous, the former dotted with fuscous, the latter streaked with piceous along the middle; inner face and lower edge, together with the sulcus, strongly reddish purple, the greater part of the former dark piceous; genicular lunules pale. Hind tibiae and tarsi rather closely hirsute. Venter and pectus testaceous.

Length of body, male, 15.5; of pronotum, 3.75; of tegmina, 3; of hind femora, 9.35 mm.

*Type*.—Cat. No. 9752, U.S.N.M.

*Habitat*.—A single male specimen collected during October by W. T. Foster at Sapucay, Paraguay.

**EUROTETRIX MINOR, new species.**

This insect differs from *femoratus* chiefly in its much smaller size and in coloration.

Length of body, male, 11; of pronotum, 2.85; of tegmina, 2; of hind femora, 7 mm.

*Type*.—Cat. No. 9753, U.S.N.M.

*Habitat*.—Asuncion, Paraguay; 2 male specimens collected in September by the author. They were found in a closely grazed pasture.

**PARADICHROPLUS Brunner.****TABLE FOR DETERMINATION OF SPECIES.**

- a. Hind tibiae provided with nine spines in outer row.
  - b. General color yellowish, the dorsum of pronotum and abdomen dusky. Head black..... *bilobus* Giglio-Tos
  - bb. General color greenish olivaceous, the dorsum of pronotum and abdomen light. Head concolorous..... *brunnei* Giglio-Tos
- aa. Hind tibiae provided with eight spines in outer row.
  - b. Hind tibiae of the ordinary form, the lateral edges not expanded and acute.
    - c. Moderately robust, the head large. General color ferruginous, irregularly and obsoletely variegated with greenish fuscous..... *bipunctatus* Giglio-Tos
    - cc. More slender, fusiform, the head not large. General color brownish olivaceous..... *fusiformis* Giglio-Tos
  - bb. Hind tibiae expanded apically and with the lateral edges acute.
    - aberrans* Giglio-Tos

**PARADICHRPLUS BILOBUS** Giglio-Tos.

*Paradichroplus bilobus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 34.

*Habitat*.—This species is recorded only from the Province of Jujuy, Argentina, and from the Bolivian Chaco. It is quite likely distributed into Paraguay as well. Not in the material studied.

**PARADICHRPLUS BRUNNERI** Giglio-Tos.

Plate XXXVII, fig. 5, female; Plate XXXVIII, fig. 6, male.

*Paradichroplus brunneri* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 25.

*Habitat*.—Not in the collections, but reported from Asuncion, Province of San Pedro, etc. (Giglio-Tos, Bruner). It also occurs in Argentina, where it is abundant as far south as Rosario de Santa Fe.

**PARADICHRPLUS BIPUNCTATUS** Giglio-Tos.

*Paradichroplus bipunctatus* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1894, No. 184, p. 26.

*Habitat*.—A single female from Sapucay, Paraguay, is referred here. It was collected by W. T. Foster. Reported from Asuncion and the Province of San Pedro (Giglio-Tos). It also abounds in northern Argentina and the Bolivian Chaco.

**PARADICHRPLUS FUSIFORMIS** Giglio-Tos.

*Paradichroplus fusiformis* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, XII, 1897, No. 302, p. 35.

*Habitat*.—Not contained in the collections, but reported from Asuncion, Paraguay, San Lorenzo, Province of Jujuy, Argentina, and San Francisco, Bolivian Chaco, as well as a couple of localities in Brazil.

**PARADICHRPLUS ABERRANS** Giglio-Tos.

*Paradichroplus aberrans* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 28.

*Habitat*.—Reported by Giglio-Tos from the Colonia Risso, on the Rio Apa, Paraguay.

Judging from the structure of the hind tibiae of this insect, as described by Giglio-Tos, it is more or less aquatic in its habits.

**OSMILIA** Stål.

The two Paraguayan species of this genus may be separated as follows:

- a. Larger. Base of wings light bluish ..... *violacea* (Thunberg)
- aa. Smaller. Base of wings sordid yellowish-hyaline ..... *obliqua* (Thunberg)

## OSMILIA VIOLACEA (Thunberg).

*Gryllus violaceus* THUNBERG, Mém. Acad. St. Petersb., IX, 1824, p. 413.

*Acridium (Osmilia) violaceum* STÅL, Recens. Orthopt., I, 1873, p. 68.

*Osmilia violacea* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 18.

*Habitat*.—Several specimens of the two sexes, Sapucay, Paraguay (W. T. Foster); Asuncion and Colonia Risso, Paraguay (Giglio-Tos). It is also commonly met with in Brazil, Bolivia, and northern Argentina.

## OSMILIA OBLIQUA (Thunberg).

*Gryllus obliquus* THUNBERG, Mém. Acad. St. Petersb., IX, 1824, p. 414.

*Acridium (Osmilia) obliquum* STÅL, Recens. Orthopt., I, 1873, p. 69.

*Osmilia obliqua* GIGLIO-TOS, Boll. Mus. Zool. Anat. Torino, IX, 1894, No. 184, p. 18.

*Habitat*.—Province of San Pedro and Asuncion, Paraguay (Giglio-Tos); not in collections now studied. Brazil; northern Argentina.

## EXPLANATION OF PLATES.

## PLATE XXXVI.

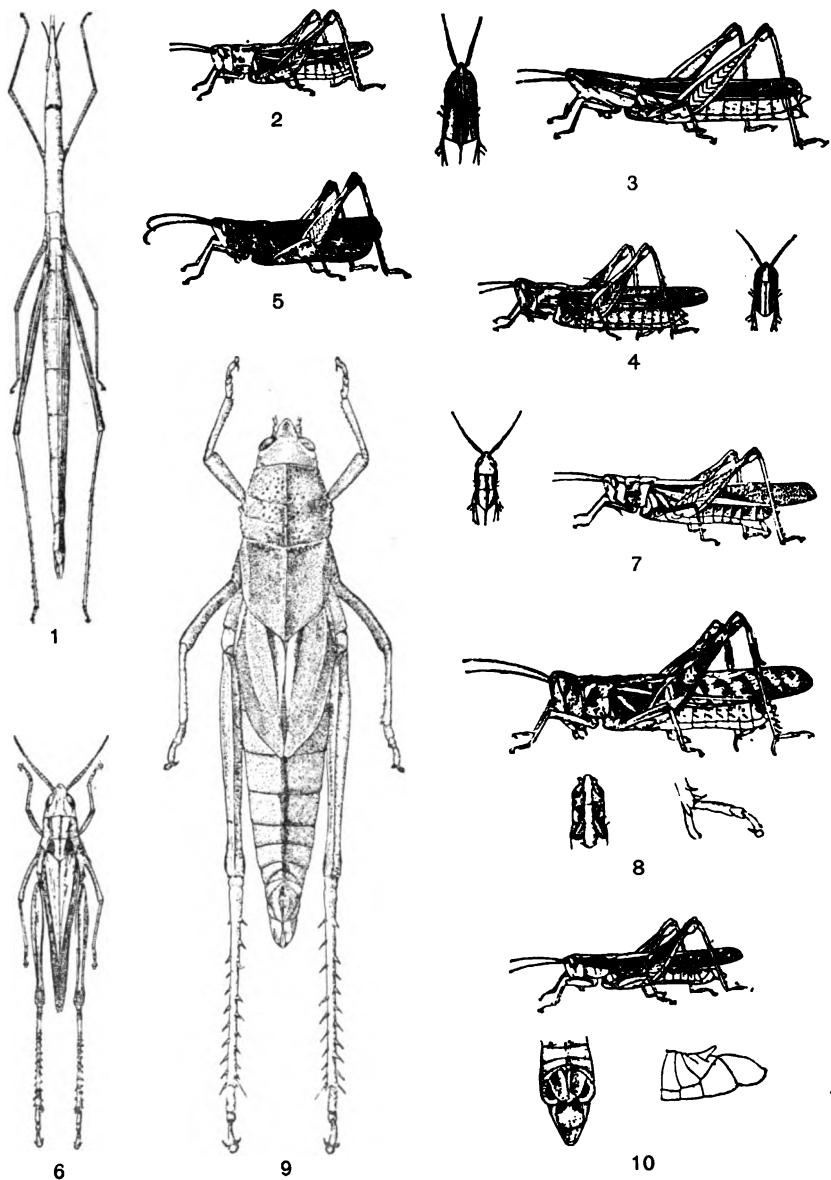
- FIG. 1. *Cephalocema costulata* Burmeister; p. 619.  
 2. *Stirapleura variabilis* Bruner; p. 634.  
 3. *Sinipta dalmani* Stål; p. 630.  
 4. *Euplectrotettix conspersus* Bruner; p. 637.  
 5. *Dichroattettix viridifrons* Bruner, male; p. 632.  
 6. *Dichroattettix viridifrons* Bruner, female; p. 632.  
 7. *Parorphula graminea* Bruner; p. 626.  
 8. *Plectrotettix pictus* Bruner; p. 636.  
 9. *Elæochlora viridicata* (Serville), female; p. 651.  
 10. *Dichroplus elongatus* Giglio-Tos; p. 681.

## PLATE XXXVII.

- FIG. 1. *Græa horrida* Philippi; p. 640.  
 2. *Zoniopoda tarsata* (Serville); p. 652.  
 3. *Zoniopoda omnicolor* (Blanchard); p. 655.  
 4. *Schistocercu paranensis* (Burmeister); p. 676.  
 5. *Paradichroplus brunneri* Giglio-Tos, female; p. 693.  
 6. *Diponthus communis* Bruner; p. 657.  
 7. *Tropinotus levipes* Stål; p. 648.  
 8. *Spathalium hispidum*, male, Bruner; p. 639.

## PLATE XXXVIII.

- FIG. 1. *Leptysmia pallida* Giglio-Tos; p. 658.  
 2. *Chromacris stolli* (Pictet and Saussure); p. 651.  
 3. *Dichroplus punctulatus* (Thunberg); p. 681.  
 4. *Dichroplus punctulatus* (Thunberg); p. 681.  
 5. *Ossa viridis* (Giglio-Tos); p. 638.  
 6. *Paradichroplus brunneri* Giglio-Tos, male; p. 693.  
 7. *Elæochlora viridicata* (Serville), male; p. 651.  
 8. *Atrachelacris unicolor* Giglio-Tos, female; p. 677.  
 9. *Atrachelacris unicolor* Giglio-Tos, male; p. 677.  
 10. *Aleuas lineatus* Stål; p. 668.  
 11. *Spathalium hispidum*, female, Bruner; p. 639.



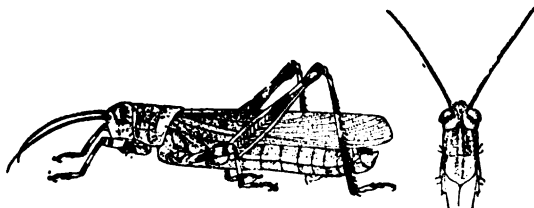
PARAGUAYAN ACRIDIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 694.





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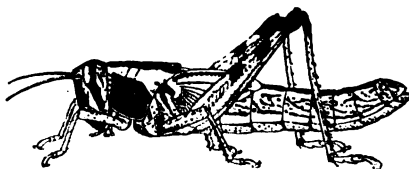
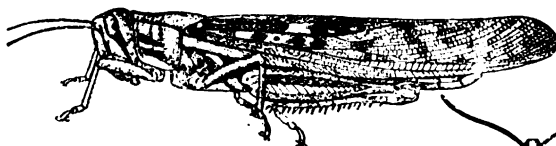
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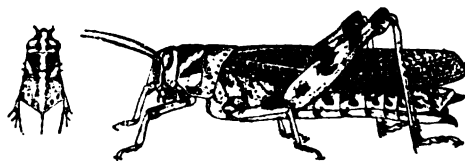
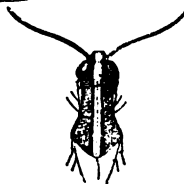
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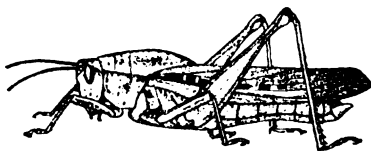
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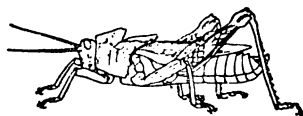
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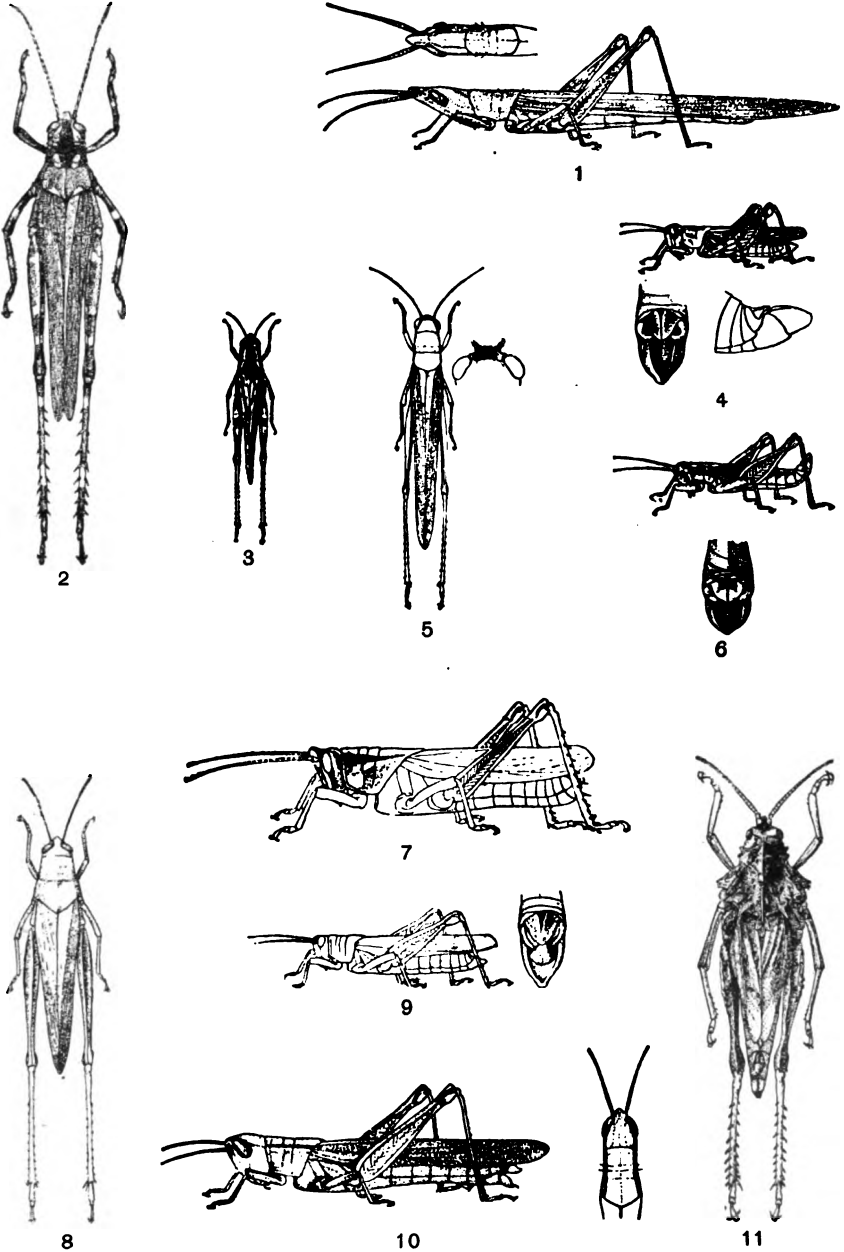


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PARAGUAYAN ACRIDIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 694.





PARAGUAYAN ACRIDIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 694.



LIST OF FISHES COLLECTED ON TANEGA AND YAKU,  
OFFSHORE ISLANDS OF SOUTHERN JAPAN, BY  
ROBERT VAN VLECK ANDERSON, WITH DESCRIPTIONS  
OF SEVEN NEW SPECIES.

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By DAVID STARR JORDAN and EDWIN CHAPIN STARKS,  
*Of Stanford University, California.*

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For the year 1904-5, Mr. Robert Van Vleck Anderson, a graduate student of Stanford University, was engaged in the field study of the birds of Japan. On the islands of Yaku and Tanega (Yakushima and Tanegashima) he made an interesting collection of fishes of the tide-pools. Among the species obtained are seven which seem to be new

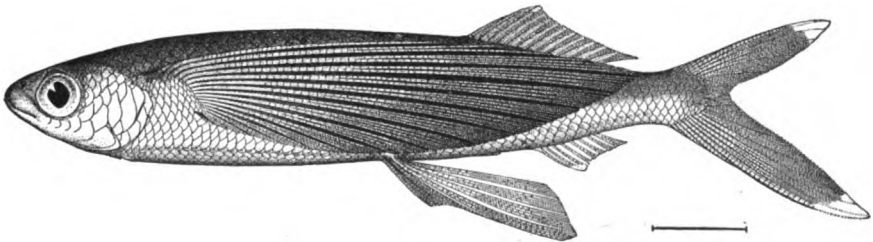


FIG. 1.—*CYPSILURUS AGOO*.

to science. These islands lie offshore, to the southeast of the large island of Kiusiu. Series of the specimens obtained are in the United States National Museum and in the collection of Stanford University. The figures presented in this paper were drawn by Mr. William Sackston Atkinson.

The new species are: *Corythoichthys tanakæ*; *Atherina morrissi*; *Cristiceps flammeus*; *Blennius ellipes*; *Salarias andersoni*; *Salarias tanegasimæ*; *Petroscirtes loxozonus*.

Family ANGUILLIDÆ.

*ANGUILLA JAPONICA* Schlegel.

Two specimens from Miyanoura ("inlet of the temple"), Yakushima.

Family EXCETIDÆ.

*CYPSILURUS AGOO* (Schlegel).

One specimen from Yakushima.

## Family SYNGNATHIDÆ.

**CORYTHOICHTHYS TANAKÆ** Jordan and Starks, new species.

Head,  $8\frac{1}{2}$  in length to base of caudal; depth, 14. Eye, 5 in head; snout,  $2\frac{1}{2}$ ; dorsal, 20; body rings, 16-30.

Top of head steeply but nowhere abruptly sloping to snout; snout somewhat curved upward; a low median ridge on top of head in line with a similar ridge on occipital plate and on first body ring; these more or less separated at sutures between plates; a slight ridge running back from supraocular region; another slight ridge running horizontally across opercle; a prominent supraorbital tentacle present; a longer one, nearly as long as eye, on median ridge of head; and another smaller than the last on ridge of occipital plate, or frequently considerably at one side or the other of the ridge; snout a little shorter than postorbital part of head, a slight even ridge along its upper edge.

Body anterior to vent considerably deeper than wide in either sex; behind vent regularly quadrangular, broken only by the egg pouch in the male. A median ridge on belly from isthmus to vent. Lower lateral ridge of trunk in line with, but not continuous with lower



FIG. 2.—*CORYTHOICHTHYS TANAKÆ*.

ridge of caudal, separated from it by a very short interval opposite vent. Lateral ridge of trunk dipping abruptly down opposite vent and continued as lower caudal ridge. Upper ridges of trunk converging at occiput, sometimes the area between them at this point is concave; posteriorly each ridge ends under posterior third of base of dorsal. Upper caudal ridge bends down opposite dorsal and runs below posterior end of upper ridge of trunk, end of upper ridge of trunk ending opposite front of dorsal. Caudal pouch covering 15 rings and contained in caudal portion of body  $1\frac{1}{2}$  times. Length of pectoral equal to diameter of eye and slightly shorter than caudal. Dorsal covering one body ring and 4 caudal rings.

Color of male specimens dark brown with 10 or 11 light cross bars on back between upper ridges; 1 at occiput, 3 in front of dorsal, 1 under middle of dorsal, and the others spaced regularly behind dorsal, these bars usually not extending across sides, but in one or two examples they are faintly and irregularly indicated. Three conspicuous dark spots on upper part of side of trunk below upper ridge; the anterior are sometimes faint. Two light irregular streaks running downward from eye give the lower part of head a mottled appearance. The females are lighter; two of them nearly colorless, the other very light brown and with the cross bars extending down across the sides.

The dark lateral spots of the male are absent in our specimens of the female.

This species may be known by its short, thick, compressed body and by the coloration of the male. Eight specimens were collected at Tanegashima, in length from 57 to 70 mm. Five of them are males.

The type is 70 mm. long and is numbered 53271, U. S. N. M. A cotype is No. 9358, Stanford University. The species is named for Mr. Shigeo Tanaka, of the Imperial University of Tokyo.

### Family ATHERINIDÆ.

#### *ATHERINA MORRISI* Jordan and Starks, new species.

Head, 4 in length to base of caudal; depth,  $4\frac{1}{2}$ . Eye,  $2\frac{3}{4}$  in head; snout,  $3\frac{1}{2}$ ; interorbital space,  $2\frac{3}{4}$ ; maxillary,  $2\frac{3}{4}$ ; dorsal, VI-I, 10; anal, I, 14; scales, 45.

Jaws equal; the maxillary reaching to below middle of eye. Teeth in narrow bands; narrower on lower jaw than upper. The teeth on palatine in a very narrow band not continuous with that of vomer.

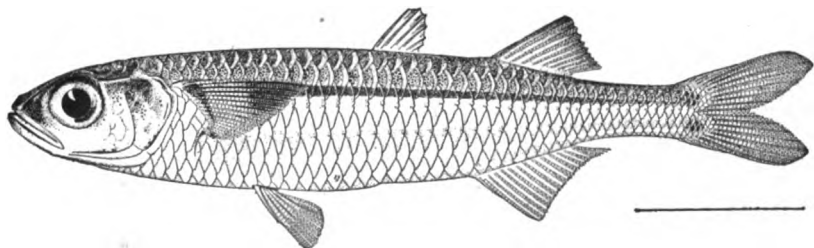


FIG. 3.—*ATHERINA MORRISI*.

Eye very large, equal to postorbital part of head. Gill rakers long and slender, the longest  $\frac{2}{3}$  of diameter of eye, 20 on lower limb of arch.

Scales with entire, but slightly uneven edges, feeling a little rough to the touch. Seven transverse series of scales below spinous dorsal; 18 scales in the median row on back between spinous dorsal and occiput; 8 between basis of dorsals.

Origin of spinous dorsal midway between base of caudal and middle of eye; distance from front of first dorsal to front of second contained  $1\frac{1}{2}$  in head. Pectoral sharply pointed, its longest ray  $1\frac{1}{2}$  in head, its tip reaching to above beginning of posterior third of ventral. Insertion of ventrals midway between front of anal and middle of eye; tips of ventrals reach  $\frac{1}{2}$  of distance from their bases to front of anal. Length of base of anal equal to distance from base of last anal ray to base of lower rudimental caudal rays. Vent just posterior to tips of ventrals.

Color dusky above with dark points, silvery below. A wide lateral band bordered above with a narrow lead-colored stripe. Lateral band entirely covering third row of scales below spinous dorsal and extending across lower angles of second row; its lower edge extends down

nearly to middle of fourth row. Scales on back slightly bordered with bluish. Snout and tip of mandible black; dorsals and caudal dusky; pectoral blackish toward tip; ventrals and anal with the least tinge of dusky, nearly colorless.

This species resembles *Atherina lacunosa* Forster in having a short stout body and large eye. It differs from it in having the maxillary longer and the lateral band wider. A specimen of the latter species from Sydney in the Stanford University collections has the maxillary reaching just past front of eye, scarcely to front of pupil, and upper edge of lateral band just above middle of third row of scales below spinous dorsal; its lower edge not reaching the lower points of the third row of scales, but slightly involving the upper points of the fourth row. From *Atherina tsurugæ* it may be known by the longer maxillary, stouter body, and larger head and eye.

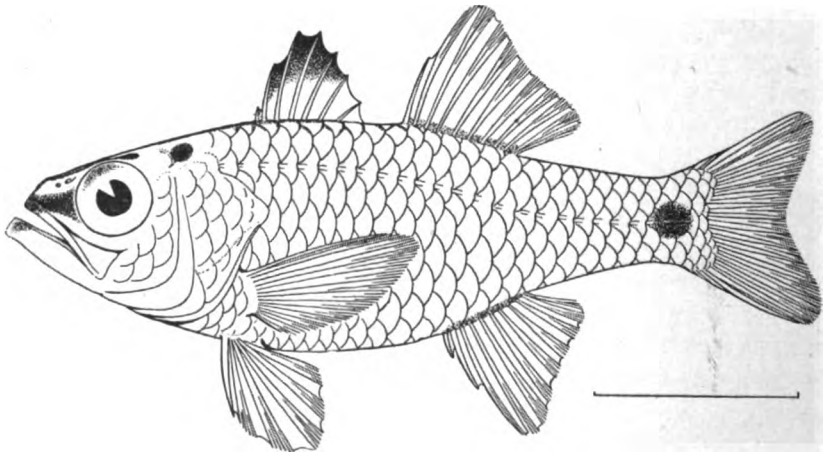


FIG. 1.—*AMIA NOTATA*.

The type and sole specimen is 12 cm. in length and was taken at Miyanouura, Yakushima. It is numbered 9359, Stanford University.

This species is named for Mr. Earl Leonard Morris, in recognition of his careful work on the fishes of Southern California.

#### Family KUHLIIDÆ.

##### *KUHLIA TÆNIURA* (Cuvier and Valenciennes).

Several small specimens from rock pools on Tanegashima.

The characteristic bands on the caudal of these young specimens are very conspicuous.

#### Family APOGONICHTHYIDÆ.

##### *AMIA NOTATA* (Houttyn).

One specimen from Yakushima.

Family KYPHOSIDÆ.

*GIRELLA PUNCTATA* Gray.

Several small specimens collected at Tanegashima and Yakushima.

Family LABRIDÆ.

*THALASSOMA CUPIDO* (Schlegel).

Many specimens collected at Miyanoura on Yakushima and two at Tanegashima.

Family CHÆTODONTIDÆ.

*CHÆTODON MODESTUS* Schlegel.

Two small specimens from rock pools at Tanegashima.

*MICROCANTHUS STRIGATUS* (Cuvier and Valenciennes).

A single young specimen 35 mm. in length, collected at Miyanoura, Yakushima. It has a distinct black blotch covering the basal half of

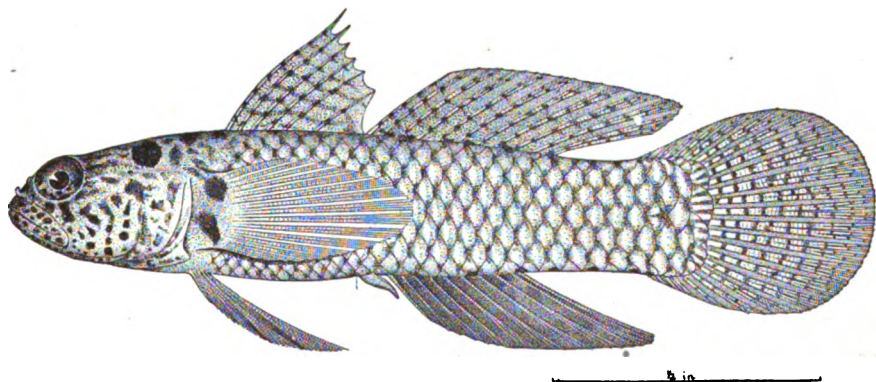


FIG. 5.—*EVIOTA ABAX*.

the anterior dorsal rays. A broken dark bar following base of anal rays. Nape with 3 cross bars, the third extending downward following edge of opercle.

Family CIRRHITIDÆ.

*CIRRHITUS MARMORATUS* Lacépède.

A specimen from Yakushima 15 cm. in length. This common species of the South Seas has not been previously recorded from Japan.

Family GOBIIDÆ.

*EVIOTA ABAX* (Jordan and Snyder).

Several specimens taken at Tanegashima. The second spine of the male of this species is of variable length, in some specimens reaching

just past front of soft dorsal, as in the figure published with the original description; in others it is filamentous and reaches past base of last dorsal ray. The anal and soft dorsal are higher in the male than in the female.

This species has the head naked and the preopercle entire. It is therefore not referable to *Asterropteria*, but rather to *Eviota* Jenkins. This species reaches a much larger size than any of the others placed by us in *Eviota*.

**RHINOGOBIUS HADROPTERUS** (Jordan and Snyder).

Numerous specimens taken one-fourth mile above mouth of the Miyanoura, on Yakushima. This species belongs to the subgenus or group called *Porogobius*.

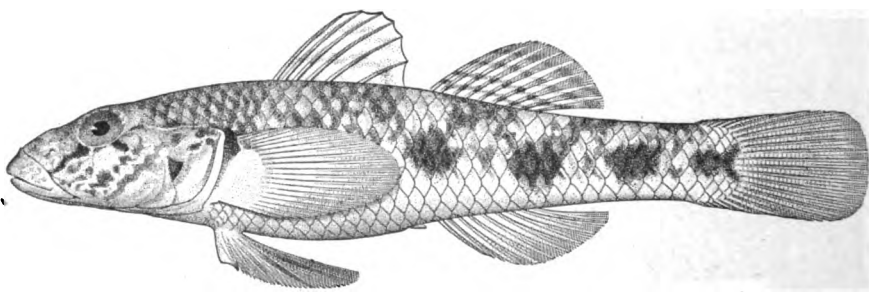


FIG. 6.—RHINOGOBIUS HADROPTERUS.

Family CHAMPSODONTIDÆ.

**CHAMPSODON VORAX** Gunther.

One specimen from Miyanoura, Yakushima.

• Family BLENNIIDÆ.

**ENNEAPTERYGIUS ETHEOSTOMA** (Jordan and Snyder).

Several specimens taken at Tanegashima. All of the Pacific species referred to *Tripterygion* seem to be generically distinct from the type

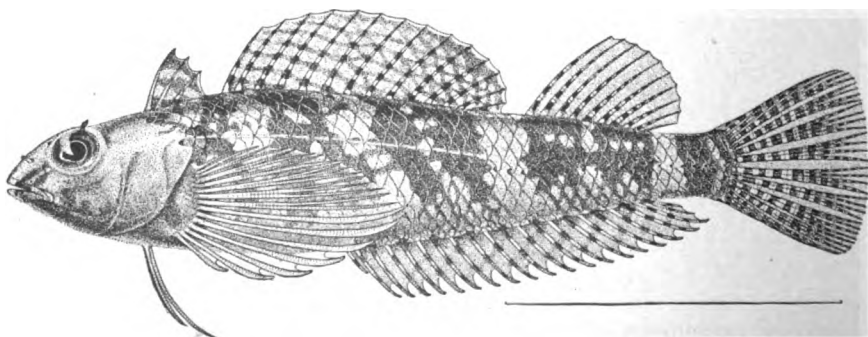


FIG. 7.—ENNEAPTERYGIUS ETHEOSTOMA.

of the latter genus, which is a species of the Mediterranean. We have therefore revived the name *Enneapterygius*, based on a species of the Red Sea.

**CRISTICEPS FLAMMEUS** Jordan and Starks, new species.

Head,  $4\frac{1}{2}$  in length to caudal base; depth,  $4\frac{1}{2}$ . Eye,  $4\frac{1}{2}$  in head; interorbital space,  $6\frac{1}{2}$ ; snout, 4; maxillary, 2. Dorsal III, XXVI, 5; anal II, 20. Scales, about 87.

Mouth rather oblique; the jaws equal. Maxillary extending slightly past posterior orbital margin. Teeth rather blunt; in a single row on sides of mandible, in a small patch in front, and in a band on premaxillary. Teeth on vomer in a crescent-shaped patch continuous with the palatine patches. Interorbital space narrow and appearing convex, but the bone is concave or channeled along its middle. Short, flat,

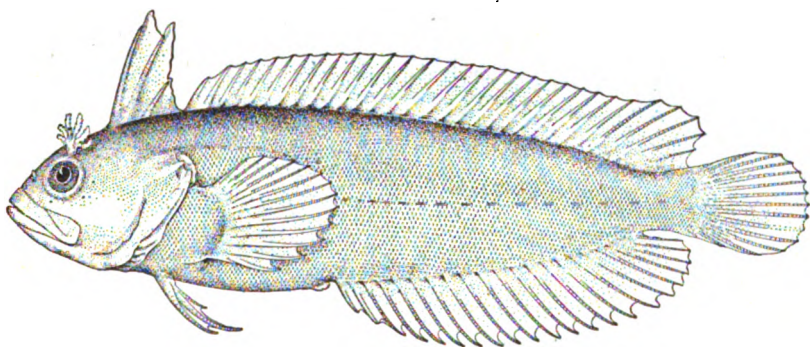


FIG. 8.—*CRISTICEPS FLAMMEUS*.

digitate flaps present above eyes; the divisions not extending to base of flaps and subdivided into fine fringers. The hooked process on shoulder girdle prominent.

First two dorsal spines equal in length and equal to distance from middle of eye to opercular flap; the third spine half as long and attached to extreme base of first spine of second portion of dorsal. Spines of second portion of dorsal growing gradually longer posteriorly; the last is shorter than soft rays, its length equal to combined length of snout and eye. Tips of last dorsal rays reaching to opposite base of caudal; the last ray attached to caudal peduncle by membrane. Anal spines shorter than rays, the second  $3\frac{1}{4}$  in head. Membrane of anal deeply incised; the last rays not reaching so far back as those of dorsal. Pectoral broadly rounded. Ventrals 3 rayed, the middle ray the longest, the inner ray half the length of the outer. Ventrals reaching two-thirds of distance from their base to front of anal. Caudal rounded.

Color in spirits everywhere light grayish without markings or shading. When received in formalin it was a bright orange. This species

is apparently more nearly related to *Cristiceps roseus* Günther than to any other. It differs in having palatine teeth and no nasal tentacle.

The type and sole specimen is 83 mm. in length, and was collected at Tanegashima. It is numbered 9360, Stanford University.

**BLENNIUS ELLIPES** Jordan and Starks, new species.

Head, 5 in length to base of caudal; depth,  $5\frac{1}{4}$ . Eye,  $3\frac{1}{4}$  in head; maxillary,  $2\frac{1}{4}$ ; snout, 3; interorbital space, 7. Dorsal XI, 20; anal 23.

Head shaped much as in *Salarias andersoni*, having the orbital region produced, the front of the head subvertical, and the mouth under the eye. Front of maxillary a little anterior to eye, and posterior end of maxillary about the same distance behind eye. This character is variable, owing to distortion of head. Teeth movable, in a single even row on jaws; about 30 on mandible; a strong hooked canine inside of each end of mandibular band. A long, slender, simple tentacle

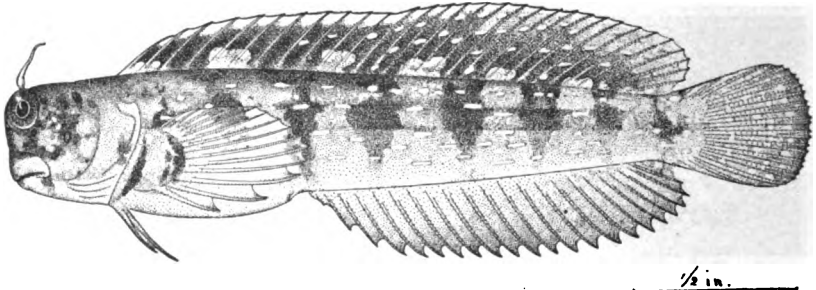


FIG. 9.—BLENNIUS ELLIPES.

present above eye; no nasal tentacle. Interorbital space narrow and concave. A ring of rather large pores extending irregularly around eyes.

Origin of dorsal considerably in front of the vertical from tip of opercle. Dorsal not notched; the rays unbranched and only differentiated from the spines by having cross articulations. Tips of last dorsal rays reaching to or a little past base of caudal; the last ray attached to caudal peduncle by membrane. Membrane of anal more deeply incased than that of dorsal. Pectoral rounded or obtusely pointed; its tip reaching to opposite vent. Length of ventral,  $1\frac{1}{4}$  in head.

Color light gray with dusky cross bands extending down to middle of sides. These are 7 in number, definitely arranged, their edges softly blended to the ground color, and each band separated at the middle into an upper and a lower portion. Dorsal dusky and somewhat marbled at base of spines and rays; anal growing slightly dusky toward tips of rays, caudal dusky, and inconspicuous light dots form faint cross lines; pectoral and ventrals light or sometimes very slightly dusky.

Numerous specimens were taken at Tanegashima and four at Yakushima; the longest 70 mm. in length.

The type is 60 mm. long and was taken at the former locality. It is numbered 53272, U. S. N. M. A cotype is No. 9361, Stanford University.

***SALARIAS ENOSIMÆ* (Jordan and Snyder).**

Numerous specimens collected at Miyanoura, Yakushima, and at Tanegashima. They usually have the orbital tentacle fringed at the

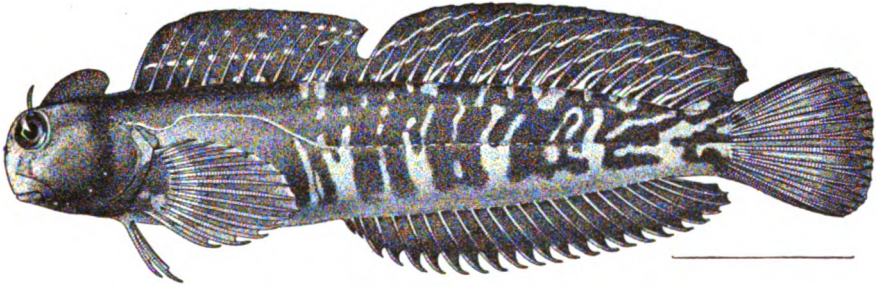


FIG. 10.—*SALARIAS ENOSIMÆ*.

edges and longer than in the typical specimens. This species, with the next two, belongs to the subgenus *Scartichthys*. This group differs from *Salaria* proper in having the dorsal conspicuously notched.

***SALARIAS ANDERSONI* Jordan and Starks, new species.**

Head,  $5\frac{1}{2}$  in length to caudal base; depth,  $5\frac{1}{2}$ . Eye, 4 in head; maxillary, 3; interorbital space, 9. Dorsal XI, 19 or 20; anal, 20 to 22.

Head produced at orbital region and overhanging the mouth; region between eye and upper lip a little concave. Front of mouth under

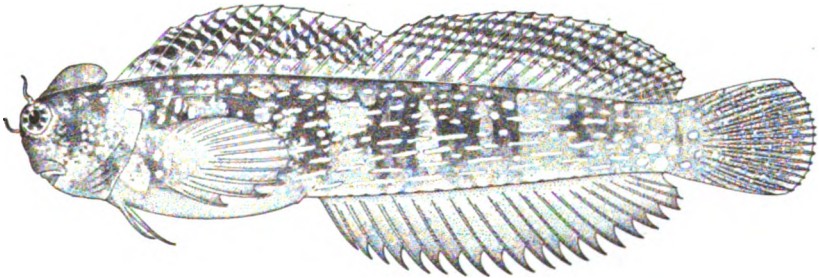


FIG. 11.—*SALARIAS ANDERSONI*.

front of pupil; maxillary extending considerable past eye. Teeth in a comb-like, single, even row, attached to flesh of jaws; upper lip not fringed. A rather long nasal tentacle present in front of eye, and a much longer, slender, supraorbital tentacle, attached to upper part of

eyeball. A high thin flap of skin on top of head extending from between posterior margin of eyes to occiput. Pores of lateral line not extending past tip of pectoral.

Notch between spinous and soft portions of dorsal not very deep, the membrane of the last spine extends  $1\frac{1}{4}$  times the diameter of the eye above the base of the first ray. Origin of dorsal a little in front of opercular flap; last dorsal rays extend slightly past base of caudal, and are bound by membrane to caudal peduncle; membrane between dorsal rays scarcely incised. Anal coterminous with dorsal; the membrane between anal rays incised nearly half way from base to tip of rays. Pectoral rather broad, its length equal to that of head. Inner ray of ventral the longer, its length  $1\frac{1}{4}$  in head. Caudal rather broadly rounded.

Color dusky brown, marked on sides with narrow, definite, longitudinal, light lines, interrupted at short and irregular distances. Distal half of dorsal spines crossed by small oblique, alternate light and dark lines, growing darker anteriorly. Soft dorsal similarly marked, but much lighter and the markings extending lower on fin. Anal dusky, growing gradually darker toward ends of rays. Pectorals and ventrals slightly dusky; caudal crossed by fine wavy lines.

This species may be known from other Japanese members of its genus by the produced orbital region, and by the color.

Four specimens were collected at Tanegashima, the type and largest specimen is 79 mm. in length. It is numbered 53273 U.S.N.M. Co-types are No. 9362, Stanford University.

The species is named for Mr. Robert Van Vleck Anderson.

**SALARIAS TANEGASIMÆ** Jordan and Starks, new species.

Head,  $4\frac{1}{2}$  in length to base of caudal; depth at ventral fins, 6. Eye,  $4\frac{1}{2}$  in head; snout,  $3\frac{1}{2}$ ; maxillary,  $2\frac{1}{2}$ . Dorsal XII, 18; anal, 20.

Snout blunt, broadly rounded in profile. Eyes projecting slightly above upper profile of head; separated by a very narrow concave inter-orbital space scarcely wider than diameter of eye. A rather long supraorbital tentacle of variable length and usually fringed on the edges is present. Mouth broadly curved and subinferior, the maxillary reaching to below posterior margin of orbit, upper lip fringed on the edge with a single row of papillæ. Teeth as in *S. enosimæ*. Top of head without a median crest of skin; sometimes a ridge or an inconspicuous low fold of skin is present.

Posterior rays of soft dorsal not reaching past base of caudal; in *S. enosimæ* they reach considerably past. Longest rays of soft dorsal contained  $1\frac{1}{4}$  in head;  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in head in the latter species. Spinous dorsal a little lower than soft dorsal; the longest spines  $2\frac{1}{4}$  in head. Notch between spinous and soft rays of dorsal very deep, nearly separating the fin into two parts.

Color very much as in *S. enosimæ*, but the anal always white instead of black, and the dorsal without the narrow light lines.

This species differs from *S. enosimæ* Jordan and Snyder in having no median crest on top of head, the dorsal and anal fins not so high, and the anal white.

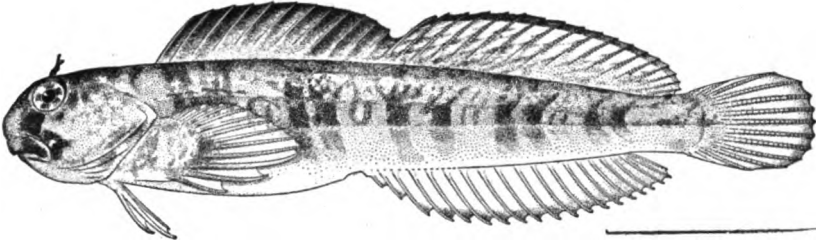


FIG. 12.—*SALARIAS TANEGASHIMÆ*.

Numerous specimens, the largest 84 mm. in length, were collected at Tanegashima, and at Miyanoura, Yakushima.

The type is numbered 53274, U.S.N.M. Cotypes are 9363, Stanford University.

**PETROSCIRTES LOXOZONUS** Jordan and Starks, new species.

Head, 5 in length to base of caudal; depth,  $6\frac{1}{2}$ . Eye, 5 in head; snout,  $3\frac{1}{2}$ ; maxillary,  $3\frac{1}{2}$ ; interorbital space, 7. Dorsal XIII or XIV, 20; anal, 24.

Upper profile of head broadly rounded from nape to tip of blunt snout, sometimes the curve slightly interrupted at orbital region. Mouth small; the maxillary reaching to below middle of eye; lower jaw

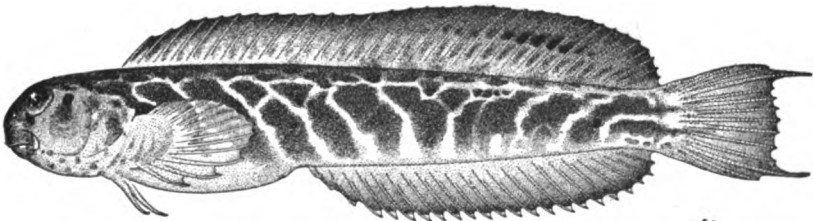


FIG. 13.—*PETROSCIRTES LOXOZONUS*.

included, the teeth sloping forward and even with those of premaxillary. Teeth in a single even row, slightly movable, but not so much so as in species of *Salaria*; a single curved canine at posterior end of premaxillary band of teeth. Interorbital space convex, no tentacles present. Gill slit scarcely reaching below upper edge of base of pectoral; its length  $\frac{1}{2}$  of diameter of eye.

Dorsal continuous, not elevated in front, and with flexible spines and rays, the latter unbranched and differentiated from the former by

cross-articulation, which are only evident under considerable magnification; the posterior 20 are rays. Base of first dorsal spine directly above gill slit. The dorsal of the male is a little higher than that of the female. In the male the longest dorsal rays are contained  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head; in the female  $1\frac{1}{2}$  to  $1\frac{1}{4}$ . Caudal in the female truncate or very slightly rounded; in the male the upper and lower rays produced and filamentous. Pectoral rounded, its length half as long as the space between its base and front of anal. Ventral with 2 rays; the inner ray the longer, reaching  $\frac{2}{3}$  of distance from its base to vent.

Color light gray; the sides crossed with many dark bands a little wider than the spaces between them, and with edges blended to the lighter color. Posteriorly the bands slope downward and forward; anteriorly, downward and backward; at a little behind the middle of the body the 2 sorts of bands are separated by a V-shaped mark. A conspicuous dark spot just behind eye. Dorsal of female without color, or light and crossed with indistinct dusky wavy lines. Dorsal of male dark, nearly black, and with a black spot across the middle of the eighth to the tenth or eleventh rays from the posterior end. Anal dusky, growing darker toward tips of rays; darker in males than in females.

This species differs from other members of its genus in the pattern of its color markings.

Numerous specimens were taken at Tanegashima, in length from 40 to 70 mm.

The type is 64 mm. in length and is numbered 53275 U.S.N.M. Cotypes are No. 9364 Stanford University.

This species belongs to the subgenus *Aspidontus*, distinguished from typical *Petroscirtes*, by the low anterior spines of the dorsal. In the type of *Petroscirtes* these are much elevated.

#### NOTE ON ANARHICHAS FASCIATUS BLEEKER.

The wolf fish mentioned by Jordan and Snyder<sup>a</sup> from Mombetsu, in Iburi, Japan, as *Anarhichas* species, is doubtless the species described from China as *Anarrhichas fasciatus*.<sup>b</sup>

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<sup>a</sup> Proc. U. S. Nat. Mus., XXV, 1902, p. 502.

<sup>b</sup> Bleeker, Nederl. Tyds., 1873, p. 151.

## A REVIEW OF THE AMERICAN MOTHS OF THE GENUS COSMOPTERYX HÜBNER.

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By AUGUST BUSCK,  
*Of the U. S. Department of Agriculture.*

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The little moths belonging to the genus *Cosmopteryx* are probably familiar to anyone who has collected and observed insects in nature. Who has not occasionally on a warm midsummer day met with a slender little streak of gold and silver sitting in the sunshine on a leaf in a protected corner and twirling its long white-tipped antennæ in graceful motions? If, when examined more closely, it is found to be a smooth shining little moth, brown with silvery lines on palpi and antennæ, and with a striking broad golden or orange fascia across the outer half of the wing, bordered on both sides by bright metallic scales, then you have a *Cosmopteryx*.

Most of the species may at once be recognized by this characteristic ornamentation alone, without structural examination.

The genus belongs to the family Elachistidæ, and has the following structural characters: Face and head smooth. Labial palpi very long, smooth, recurved, pointed; terminal joint longer than second joint. Maxillary palpi obsolete. Antennæ nearly as long as the forewings, simple; basal joint very long. Forewings very long, narrow; apex produced, pointed; 12 veins (or sometimes only 11, vein 5 being absent); 6, 7, and 8 from a common stalk; 7 to costa; 1 b furcate at base. Hindwing linear with very long cilia; venation limited to a costal and a subcostal vein, and a simple or forked median vein; transverse vein, and veins 5, 4, and sometimes 3 being obsolete. Legs long, posterior tibiæ rough-haired.

The larvæ are leaf miners, and the mines are easily distinguished from most others by the scrupulous cleanliness with which the larva ejects all its frass through a hole, so that the mine remains clear and white. At maturity the larva changes its color from green to a vivid purple or wine-red, leaves the mine, and spins a matted flattened cocoon of silk.

The different species are very uniform in general appearance, but are not difficult to separate by small, but quite easily seen, characters.

Thus Lord Walsingham pointed out<sup>a</sup> the value of the different positions of the white annulations of the antennæ, and suggested that the species might be tabulated by that character alone. Aside from the fact, however, that the tip of the antennæ is about the most vulnerable point, and often lost in a dry specimen, the white annulations are not quite so constant as Lord Walsingham supposed, differing occasionally in the same specimen. Nevertheless, they furnish a valuable help in the identification, and I have, in the following, given the coloration in all the species, where I know it, as it may eventually become of more importance.

The species described by the writer<sup>b</sup> as *Cosmopteryx villella* was at the time known only from a unique example with wings folded; even this, however, hardly excuses the mistake of referring it to the present genus; examination of the venation disclosed that the species does not belong in this genus, but in the somewhat related genus *Chrysoclista* Stainton, which thus for the first time is recorded from this continent.

The American species may be separated by the following table:

TABLE OF SPECIES OF COSMOPTERYX.

|   |                    |
|---|--------------------|
| Forewings with white markings on basal half.....                                    | 1                  |
| Forewings without white markings on basal half.....                                 | 12                 |
| 1. Basal half with short longitudinal white streaks <i>only</i> .....               | 2                  |
| Basal half with longitudinal white lines .....                                      | 6                  |
| 2. Basal metallic margin of fascia nearly perpendicular on edge .....               | 3                  |
| Basal metallic margin of fascia strongly oblique .....                              | 5                  |
| 3. Dorsal edge white at base..... <i>pulcherrimella</i>                             |                    |
| Dorsal edge not white.....  | 4                  |
| 4. Apical margin of fascia nearly perpendicular..... <i>clemensella</i>             |                    |
| Apical margin of fascia strongly oblique..... <i>gemmiferella</i>                   |                    |
| 5. Head and thorax with three prominent longitudinal lines..... <i>attenuatella</i> |                    |
| Head and thorax with one faint central line .....                                   | <i>ipomææ</i>      |
| 6. Forewings with yellow or orange fascia.....                                      | 7                  |
| Forewings without such fascia..... <i>unicolorella</i>                              |                    |
| 7. Expanse of forewings less than 8 mm .....  | 8                  |
| Expanse more than 10 mm. ....   | 11                 |
| 8. Metallic spots surrounded by yellow..... <i>quadritineella</i>                   |                    |
| Metallic spots edging the yellow .....  | 9                  |
| 9. With black discal spots between first metallic spot and fascia .....             | 10                 |
| Without such black spot .....   | <i>chalybeella</i> |
| 10. Apical pair of metallic spots not touching edges of wing .....                  | <i>delicatella</i> |
| Both apical metallic spots reaching the edge..... <i>minutella</i>                  |                    |
| 11. Forewings light drap colored..... <i>fernaldella</i>                            |                    |
| Forewing deep brown .....   | <i>monticella</i>  |
| 12. Yellow fascia divided by longitudinal black streak .....                        | <i>nitens</i>      |
| Fascia not thus divided..... <i>clandestinella</i>                                  |                    |

<sup>a</sup> Insect Life, I, 1889, p. 289.

<sup>b</sup> Proc. U. S. Nat. Mus., XXVII, 1904, p. 768.

**COSMOPTERYX PULCHERRIMELLA Chambers.**

*Cosmopteryx pulcherrimella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 6072.

There is in the National Museum a series of *Cosmopteryx*, bred by Miss M. Murtfeldt in Kirkwood, Missouri, from *Pilea pumila* and rightly determined by Lord Walsingham in 1889 as the present species. There are also two specimens determined by him from North Carolina (Morrison.) I have examined identical specimens in Professor Fernald's collection, but Chambers's original type from Kentucky is not in existence.

The species has the following antennæ coloration: Terminal 4 joints white, preceding 5 joints white, next 2 black, next 1 white, next 1 black, and the following 1 white.

Miss Murtfeldt has kindly given me the following notes on the larva:

Feeds on rickweed (*Pilea pumila*), a succulent little plant of the nettle family, with adhesive, but not urticating leaves; mining, twisting, and crumpling them.

Larva yellowish white, subcylindrical.

Head shining black, with the diversions defined by narrow white lines. Cervical shield broad, oblong, with fine white central line. The sutures are very deep, giving the larva a moniliform aspect.

These larvæ are not confined to one mine, but may be seen wandering over the leaves and stems, cutting in between the two cuticles of a leaf and covering it with transparent spots of various sizes. They change to pupa under a fold of the leaf or between the wrinkles or not infrequently on the surface of the ground, protected by a very slight dingy cocoon. There seems to be several broods in a season.

**COSMOPTERYX CLEMENSELLA Stainton.**

*Cosmopteryx clemensella* STAINTON, Dyar, Cat. N. Am. Lep., 1903, No. 6062.—  
Busck, Proc. Wash. Ent. Soc., V, 1903, p. 197.

I have examined Stainton's type of this species in the British Museum. In the National Museum is an identical specimen, which is evidently one of Clemens's original specimens obtained by the late Professor Riley. Other specimens from Pennsylvania; Boston, Massachusetts (Beutenmüller); Falls Church, Virginia (Banks), and Washington, District of Columbia (Busck).

The coloration of the antennæ, counting from the tip, is thus: Last 5-6 joints white, next 9-10 joints black, next 8-9 white, sometimes with a black dot on the third or fourth, sometimes with both these joints black.

**COSMOPTERYX GEMMIFERELLA Clemens.**

*Cosmopteryx gemmiferella* CLEMENS, Dyar, Cat. Lep. N. A., 1903, No. 6066.—  
Busck, Proc. Wash. Ent. Soc., V, 1903, p. 197.

Of this species the U. S. National Museum possesses a specimen, which undoubtedly originally came from Clemens and which agrees with his type in the Academy of Natural Sciences in Philadelphia.

Other specimens are from Sea Cliff, New York (Banks), and from Washington, District of Columbia (Busck).

The coloration of the antennæ, which, as in the foregoing species, is not quite constant, is as follows: 3-4 last joints white, 5-8 next joints black, 1 next white, 2 next black, 3 next white.

I believe this species feeds on morning-glory, though I have not succeeded in breeding it. There is a *Cosmopteryx* mine and larva not uncommon in this plant around Washington, and I have repeatedly taken the present species on such plants.

#### COSMOPTERYX ATTENUATELLA Walker.

*Cosmopteryx attenuatella* WALKER, Dyar, Cat. N. Am. Lep., 1903, No. 6068.

The type of the synonym *Cosmopteryx lespedezeæ* Walsingham, from Texas, is in U. S. National Museum; also a specimen from Palm Beach, Florida (Dyar) and several from Santo Domingo, West Indies (Busck). The antennal coloration is as follows: 4 last joints white, 5 next joints black, 1 next white, 1 next black.

#### COSMOPTERYX IPOMCEÆ Busck.

*Cosmopteryx ipomææ* BUSCK, Dyar, Cat. N. Am. Lep., 1903, No. 6067.

The type of this species from Palm Beach, Florida (Dyar), is in the U. S. National Museum and has the following antennal ornamentation: 3-[4?] last joints white, 5 following black, and 1 succeeding white.

#### COSMOPTERYX UNICOLORELLA Walsingham.

*Cosmopteryx unicolorella* WALSINGHAM, Dyar, Cat. N. Am. Lep., 1903, No. 6074.

I have examined the unique type of this species in Lord Walsingham's collection at Merton Hall, England. It can not be confounded with any other described American species through its total lack of a yellow or orange fascia. The species was described from California (Walsingham) and has the antennæ colored thus: 4 apical joints white, the succeeding 5 or 6 black, the next 1 joint white, the following 2 or 3 black, and the next 3 white.

#### COSMOPTERYX QUADRILINEELLA Chambers.

*Cosmopteryx quadrilineella* CHAMBERS, Dyar, Cat. N. Am. Lep., 1903, No. 6073.

The type of this very distinct little species from Texas is in the Museum of Comparative Zoology, in Cambridge, Massachusetts, received from Chambers. It is a true *Cosmopteryx*, easily distinguished from all other described American species by the suffused yellow fascia, which spreads all over the apical half of the wing and surrounds the metallic spots, instead of being limited by them as is usual.

The antennæ are lost in these types, which are the only specimens known to me.

**COSMOPTERYX CHALYBÆLLA** Walsingham.

*Cosmopteryx chalybælla* WALSINGHAM, Dyar, Cat. N. Am. Lep., 1903, No. 6061.

I have examined the type in Lord Walsingham's collection, but my notes on it are not so full as I would like. I know of no other specimens of this species, which, according to Lord Walsingham, has apex of antennæ white, "with two or more white rings preceded by a dark band before it."<sup>a</sup> The species was described from Texas.

**COSMOPTERYX DELICATELLA** Walsingham.

*Cosmopteryx delicatella* WALSINGHAM, Dyar, Cat. N. Am. Lep., 1903, No. 6063.

The type of this species from North Carolina is in Lord Walsingham's collection, where I have examined it. In the U. S. National Museum is a specimen from Washington, District of Columbia (Busck). The antennæ ornamentation is, according to the description, as follows: "Brown, the apex broadly white with two narrow white rings separated from apex by a still broader brown band."

**COSMOPTERYX MINUTELLA** Beutenmüller.

*Cosmopteryx minutella* BEUTENMÜLLER, Dyar, Cat. N. Am. Lep., 1903, No. 6069.

The type (No. 497) of this species is in U. S. National Museum; it is minus antennæ and not in very perfect condition otherwise, but is easily distinguished from the preceding and from the following species with which it has the black spot on the basal part of the fascia in common by the characters, given in the synoptic table. The description gives no mention of the antennæ and I know of no other specimen besides the type.

**COSMOPTERYX FERNALDELLA** Walsingham.

*Cosmopteryx fernaldella* WALSINGHAM, Dyar, Cat. N. Am. Lep., 1903, No. 6064.

This species is, as mentioned by the writer,<sup>b</sup> the same as described by Beutenmüller as *Cosmopteryx floridanella*<sup>c</sup> and by the writer as *C. nigrapunctella*. In the U. S. National Museum are, besides the types of both these species, other specimens from Hasting, Florida, Washington, District of Columbia (Busck), and Hazleton, Pennsylvania (Dietz). I have examined Lord Walsingham's types in Professor Fernald's collection and in England. The coloration of the antennæ distinguishes this also otherwise very distinct species from the other American forms; apical joint is black, the next 6 or 7 joints white, the following 2 black, and the next 2 white.

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<sup>a</sup> Insect Life, I, 1889, p. 289.

<sup>b</sup> Proc. U. S. Nat. Mus., XXVII, 1904, p. 769.

<sup>c</sup> Dyar, Cat. N. Am. Lep., No. 6065.

**COSMOPTERYX MONTICELLA Chambers.**

*Cosmopteryx monticella* CHAMBERS, Dyar, Cat. N. Am. Lep., 1903, No. 6070.

I have examined the types of this species in the Museum of Comparative Zoology in Cambridge, Massachusetts, and in Professor Fernald's collection. They are identical with a specimen determined by Lord Walsingham in the U. S. National Museum from California. Chambers's types came from Colorado. The antennæ have the following coloration: Apical 5 joints white, following 7 joints black, next 1 white, next 2 black.

**COSMOPTERYX NITENS Walsingham.**

*Cosmopteryx nitens* WALSINGHAM, Dyar, Cat. N. Am. Lep. N. Am., 1903, No. 6071.

Professor Fernald was so kind as to give me parts of the type material of this species during a visit to his home in 1902. Besides this specimen, which I compared with Lord Walsingham's type in England last spring, there are others, probably all from the same series, in the U. S. National Museum from Texas.

It is a striking species, easily distinguished by the longitudinal black streak in the yellow cilia, as well as by the coloration of the antennæ, which is as follows: Two apical joints white, 7 succeeding joints black, next 1 white.

**COSMOPTERYX CLANDESTINELLA, new species.**

Antennæ blackish brown; each joint of basal half dotted with silvery white; the last four apical joints white, the five preceding ones black, followed by two or three white joints. Labial palpi blackish brown, silvery on the inside, and with two longitudinal silvery white lines. Face silvery white, iridescent. Head and thorax dark brown, strongly metallic. Forewings blackish brown; basal half without any white markings, but with two oblique, converging, short, broad, somewhat confluent, bluish metallic streaks, equidistant from the base, one on the subcostal vein, the other, and somewhat larger, below the fold. Just outside the middle of the wing is a narrow, complete violet and silvery metallic fascia followed by a short space of the ground color; then follows the usual reddish yellow fascia, which has an angulated posterior edge, being much and abruptly prolonged along the costal edge; it is limited posteriorly by a large violet metallic dorsal spot and by a few metallic costal scales, which are in turn followed by a white costa streak prolonged into the cilia. Apical part of the wing dark brown, with a small silvery white dorsal dash just before the tip. Hindwings dark fuscous. Abdomen blackish brown. Legs silvery white on the inner side, black barred with white on the exterior side; posterior tibiæ with three long erect tufts of black hairs; tarsi black, each joint tipped with silvery white.

*Alar expanse*.—8 mm.

*Habitat*.—District of Columbia, Virginia, Maryland.

*Food plant*: *Panicum clandestinum*.

*Type*.—Cat. No. 9777, U.S.N.M.

Described from many specimens bred by the writer from mines collected early in June in the country surrounding Washington City.

The mine is an irregular longitudinal clear blotchmine with the frass ejected at one end. The larva is light green with short light hairs and with yellow head and thoracic shield. At maturity it assumes a brilliant wine-red color in three broad longitudinal stripes, and cuts a circular piece out of the epidermis of its mine, which it bends lengthwise and uses for a cocoon exactly like the genus *Cycloplasis* Clemens.

The imagoes issued late in July. Dr. H. G. Dyar has made the following description of the larva:

Head flattened, disk-like, elongate, clypeus rather broadly triangular, lobes meeting above, pale, unmarked. Cervical shield large, very weakly cornified, ill defined, luteous; body slightly flattened, subequal tapering at the ends, segments submoniliform; feet normal, moderate, the thoracic ones distinct pale, the abdominal ones truncate cylindrical, with a small circle of hooks; setae small and obscure, pale, without distinct tubercles, fairly long, apparently normal, iv and v separate. Color pale, with broad blotchy subdorsal and subventral broad red stripes.



## A REVIEW OF THE SAND LANCES OR AMMODYTIDÆ OF THE WATERS OF JAPAN.

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By DAVID STARR JORDAN.  
*Of Stanford University, California.*

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In this paper is given a review of the species of fishes constituting the family of Ammodytidæ, known to inhabit the waters of Japan.

### Family AMMODYTIDÆ.

Body elongate, lanceolate, compressed, naked or covered with small, cycloid or sculptured scales. Head long, the lower jaw produced, the mouth rather large; teeth in jaws small or wanting. Vomer prominent, sometimes with horny appendages. Gill openings very wide, the membranes separate or united, free from the isthmus. Pseudo-branchiæ large, lamellate. Gill rakers long and slender. Gills 4, a slit behind the fourth. Opercles well developed, the bones thin, unarmed. Premaxillaries very protractile, the maxillaries long and slender. Lateral line median or dorsal. Dorsal fin continuous, of soft rays only. Caudal fin small, forked, free from dorsal and anal. Vent behind middle of body; anal fin similar to dorsal but usually of fewer rays. Pectorals moderate, inserted low. Ventrals jugular, of a slender spine and three soft rays, or else altogether wanting. Lower pharyngeals very small, separate. No air bladder. Pyloric cæcum usually single.

Small, silvery carnivorous fishes living on sandy shores and swimming in schools, often burying themselves in the sand. They are excellent as food. They belong to the subarctic fauna and to the fauna of India.

The recent discovery of the genus *Embolichthys*, provided with jugular ventral fins shows that these fishes have no affinity with the *Percesoces*, but that they should be relegated to the neighborhood of *Ophidion* and *Fierasfer*, the association assigned to them by Cuvier and Günther.

The Ammodytidæ are divisible into five genera. These constitute three well-marked subfamilies, each of which might without violence be conceded family rank. The group is not rich in species, not more than 8 to 10 being clearly defined.

- a. Dorsal fin much longer than anal; body scaly; lateral line along side of back; dorsal and anal not elevated anteriorly; gill membranes separate.
- b. BLEEKERIINÆ. Tropical species, with the dorsal rays and the vertebrae in relatively small number, the dorsal rays being about 40, the vertebrae probably about the same; body covered with ordinary scales, finely sculptured, without oblique transverse folds of skin; no fold of skin along side of belly.
- c. Ventral fins present, jugular, the rays I, 3; jaws with small teeth.
- cc. Ventral fins wanting; jaws toothless. (*B. kallelepis* of India; *B. gilli* of unknown locality) ..... *Bleekeria*
- bb. AMMODYTINÆ. Arctic species, with the dorsal rays and the vertebrae in relatively large number, each about 60; body covered with oblique transverse folds of skin; jaws toothless; a fold of skin along each side of belly.
- d. Vomer prominent, but unarmed. .... *Ammodytes*
- dd. Vomer with a bicuspid, tooth-like prominence anteriorly. (*H. lancea* of Europe) ..... *Hyperoplus*
- aa. HYPOPTYCHINÆ. Dorsal fin opposite anal and similar in size; body naked; lateral line along middle of side; a fold of skin along middle line of belly; gill membranes united, free from isthmus ..... *Hypoptychus*

### EMBOLICHTHYS Jordan and Evermann.

EMBOLICHTHYS JORDAN and EVERMANN, Proc. U. S. Nat. Mus., XXVI, 1903, p. 693 (*mitsukurii*).

This genus includes sand lances with developed ventral fins, jugular position, with one spine and three soft rays. Dorsal rays about 40;

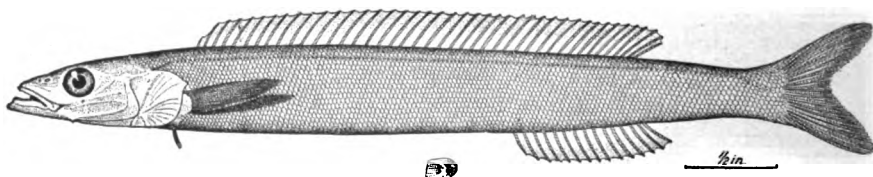


FIG. 1.—EMBOLICHTHYS MITSUKURII.

anal rays 15. Scales very small, finely sculptured, about 115; body without dermal folds. Vomer unarmed. Lateral line along side of back; no ventral fold. One species known. This genus differs from *Bleekeria* (*kallelepis*), an Indian genus, in the presence of ventral fins. (*ἔμβολος*, key, *ἰχθύς*, fish, this species giving the clue to the affinities of the group).

#### 1. EMBOLICHTHYS MITSUKURII (Jordan and Evermann).

*Bleekeria mitsukurii* JORDAN and EVERMANN, Proc. U. S. Nat. Mus., XXIV, 1902, p. 333; Giran, Formosa.

*Embolichthys mitsukurii* JORDAN, Proc. U. S. Nat. Mus., XXVI, 1903, p. 693; Giran.

*Habitat*.—Kagoshima to Formosa.

Head, 4.6 in length; depth, 8.5. Eye, 5.2 in head. Snout, 3.8. D. 42. A. 15. Scales, 115. Mouth, large, the lower jaw much project-

ing, the symphysis prominent; maxillary thin, reaching to opposite front of orbit; jaws with small teeth. Scales small, firm, well sculptured; lateral line running along side of back, two scales below dorsal, suddenly dropping to the median line on posterior part of caudal peduncle; anal short, ending under last ray of dorsal; caudal well forked; pectorals pointed, about half length of head; ventrals inserted in front of pectoral, about as long as eye; opercular bones very thin and papery. Color plain whitish. Length,  $4\frac{1}{4}$  inches.

Coasts of Formosa and southern Japan, the original types, two specimens, from Giran; a specimen taken at Kagoshima, Japan, by Dr. Hugh M. Smith.

(Named for Dr. Kakichi Mitsukuri.)

#### AMMODYTES (Artedi) Linnæus.

*Ammodytes* (ARTEDI) LINNÆUS, Syst. Nat., 10th ed., X, 1758, p. 247 (*tobianus*).  
*Argyroteenia* GILL, Cat. Fish. North. Amer., 1861, p. 40 (*vittatus*.)

Body elongate, lanceolate, the skin with many transverse folds running obliquely downward and backward, the small cycloid scales mostly in oblique cross-series between them; lateral line concurrent with the back; a fold of skin on each side of the belly; jaws without teeth; vomer prominent, but unarmed. Vertebrae about 62; dorsal rays about 60; anal rays about 30. Color silvery. Northern seas, swarming on sandy shores. Species very closely related, perhaps all relatively recent offshoots from a single one, for which the oldest name is *Ammodytes tobianus* Linnæus.

(ἄμμος, sand; δύτης, diver.)

#### 2. AMMODYTES PERSONATUS Girard.

*Ammodytes personatus* GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, p. 137; Cape Flattery.—JORDAN and GILBERT, Synopsis, 1883, p. 415; Alaska to Monterey.—JORDAN and EVERMANN, Fish N. M. Am., I, 1898, p. 833; Alaska to Monterey.

*Ammodytes tobianus* SCHMIDT, Pisc. Mar. Oriente, 1904, p. 209; Terpienia, Mauka, Eustafia, St. Katerina, Sakhalin; perhaps the same as *Ammodytes tobianus* Linnæus (Syst. Nat., 10th ed., 1758, p. 247), of the coasts of northern Europe, originally described from Sweden.

?*Ammodytes americanus* DE KAY, New York Fauna, Fishes, 1842, p. 317; Stratford, Connecticut.

?*Ammodytes vittatus* DE KAY, New York Fauna, Fishes, 1842, p. 318, pl. LX, fig. 197; New York.

?*Ammodytes alascanus* COPE, Proc. Am. Phil. Soc., 1873, p. 7; Sitka.

*Habitat*.—Coasts of the northern Pacific, on both shores. South from Alaska and Siberia to the Inland Sea of Japan, and to Monterey Bay.

Head, 4.5 in length; depth, 11; eye, 5 in head; snout, 3.5 in head; D. 54; A. 30; lateral folds, 1.53.

Body, lanceolate; maxillary extending to front of orbit; gill rakers, 17 below angle of arch; origin of dorsal over posterior third of pectorals; pectorals, 2.1 in head; longest dorsal ray about half depth of body; caudal, 2.1 in head. Color in spirits, brownish above, white below; a brownish spot on opercle above; fins pale.

This description is taken from a specimen 4 inches long, from Onomichi, on the Inland Sea. We have also specimens from Hakodate. The species is enormously abundant on sandy shores open to the sea in northern Japan. We can not separate the Japanese species from *Ammodytes personatus* of the coasts of California and northward, the only apparent difference being a number of anal rays rather higher in the Japanese species (30) than usual in the American (24). The European species *Ammodytes tobianus* Linnæus has but 120 to 130 lateral

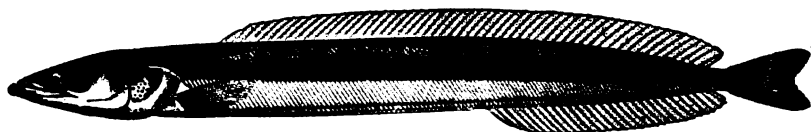


FIG. 2.—*AMMODYTES PERSONATUS* (from Onomichi).

fold, but is otherwise scarcely different. *Ammodytes americanus* of our Atlantic Coast is scarcely different from *A. tobianus*, and *Ammodytes alascanus* of the Aleutian Islands (D. 62; A. 31; folds, 160 to 182) is doubtfully distinct from *A. personatus*. At present it seems safe to identify the Japanese species as *Ammodytes personatus*.

(*Personatus*, masked.)

### HYPOPTYCHUS Steindachner.

*Hypoptychus* STEINDACHNER, Ichth. Beitr., IX, 1880, p. 20. (*dybowski*.)

Body lanceolate, formed as in *Ammodytes*, but scaleless and without oblique folds. Head pointed, the premaxillaries protractile, the chin prominent; upper jaw with small teeth; lower jaw toothless; vomer with a conical prominence. Gill openings very wide, the membranes fully united, but free from the isthmus; opercles thin, unarmed. Lateral line along middle of sides; no fold of skin on side of belly. Dorsal and anal similar, confined to the posterior part of the body, each of about 20 soft rays, the anterior rays highest; vent just before anal; pectorals rather long, symmetrical; ventrals wanting. Caudal forked. A low translucent fold of skin along middle line of belly from the base of pectorals to the vent. Branchiostegals, 4. Japan Sea. (ὕπό, below; πύχην fold).

### 3. *HYPOPTYCHUS DYBOWSKII* Steindachner.

*Hypoptychus dybowski* STEINDACHNER, Ichth. Beitr., X, 1880, p. 20, pl. II, fig. 3; Bay of Strielok, Japan Sea (near Vladivostok).—SCHMIDT, Pisc. Mar. Orient., 1904, p. 210; Bays of Patroke, Mauka, Aneva, and Corsakou; all near Vladivostok.

*Habitat*.—Japan Sea.

Head, 4.4 to 4.5; depth, 8.2 to 8.7. D. 20, A. 20, P. 9. Eye, 3.5 in head; snout, 3. Form of *Ammodytes*; first and last rays of dorsal and anal not divided. Silvery, sprinkled with dark specks.

This species is known from specimens taken by Professor Dybowski in the bays of Majen, Sydyjen, Rasbojnik, and Abrek, near Vladivostok, as also from 22 specimens procured by Dr. Peter Schmidt in the same region. We have not seen it.

(Named for Professor Dybowski.)

## SUMMARY.

## Family AMMODYTIDÆ.

## Subfamily BLEEKERINÆ.

*Embolichthys* Jordan and Evermann.

1. *mitsukurii* (Jordan and Evermann); Giran, Kagoshima.

## Subfamily AMMODYTINÆ.

*Ammodytes* (Artedi) Linnaeus.

2. *personatus* Girard; Tokyo, Onomichi, Hakodate.

## Subfamily HYPOPTYCHINÆ.

*Hypoptychus* Steindachner.

3. *dybowski* Steindachner.



# TINEID MOTHS FROM SOUTHERN TEXAS, WITH DESCRIPTIONS OF NEW SPECIES.

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By AUGUST BUSCK,  
*Of the U. S. Department of Agriculture.*

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The present collection of *Tineina*, made by Mr. Herbert S. Barber, during June, 1904, in the vicinity of Brownsville, Texas, is of special interest on account of the locality, which is one of the few tropical regions in the United States.

A large proportion of the species was found to be new to science, as would be expected from our present incomplete acquaintance with that fauna.

The writer had anticipated another special interest, hoping to recognize among the material some of V. T. Chambers's unknown or little-known Texan species, which were described from a near by, though not tropical, locality and a few of them have been rediscovered among this material. That not more of Chambers's species were found in Mr. Barber's collection is only natural, however, considering the relatively small number of species both in the present collection and that studied by Chambers.

Altogether the collection consists of 45 species in 35 genera. Of these, 3 genera and 12 species are here defined for the first time.

All of the material is in the collection of the U. S. National Museum.

## Family YPONEMEUTIDÆ.

### MIEZA SUBFERVENS Walker.

*Mieza subfervens* WALKER, Dyar, Cat. N. Am. Lep., No. 5478.

Two specimens. Lord Walsingham has pointed out<sup>a</sup> that the genus *Mieza* Walker is synonymous with Hübner's *Eustixis* but that it should be used instead of that name to avoid confusion with *Eustixia* Hübner.

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<sup>a</sup>Entom. Mo. Mag., 1893, p. 261.

**ATTEVA PUNCTELLA (Cramer and Stall).**

*Atteva aurea* FITCH, Dyar, Cat. N. Am. Lep., No. 5481.

Two specimens. This species, which is not found around Washington City, occurred commonly near St. Louis, Missouri, during the summer and autumn of 1904, where I secured a large series at light.

Recent studies of West Indian and South American material enable me to correct the following names used in Doctor Dyar's list:

*Aurea* Fitch is undoubtedly a synonym of the earlier name *punctella* Cramer and Stoll, and that species extends from the middle of North America through Central America and the West Indies down to Brazil and Argentina. Specimens from Trinidad, French Guiana, and Venezuela in the U. S. National Museum are not distinguishable from the Missouri specimens.

The name *gemmata* Grote has been wrongly used for the Florida species and belongs to the species, peculiar to Cuba, subsequently well described and figured by Zeller as *fastuosa*, which is characterized by the thin, wavy, white lines in the dominating dark, metallic, blue spots. Our very distinct brilliant, orange-red Florida species must be known under the name *floridana* Neumogen.

**PLUTELLA MACULIPENNIS (Curtis).**

*Plutella maculipennis* CURTIS, Dyar, Cat. N. Am. Lep., No. 5503.

Four specimens.

**Family GELECHIIDÆ.****PALTODORA SIMILIELLA (Chambers).**

*Paltodora similiella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 5548.

Five specimens. These are the first specimens I have seen outside of Chambers's and Zeller's types and the few other authentic specimens considered in my Revision of American Gelechiidæ.<sup>a</sup>

**SITOTROGA CEREALELLA (Olivier).**

*Sitotroga cerealella* OLIVIER, Dyar, Cat. N. Am. Lep., No. 5552.

Two specimens.

**TELPHUSA ACACIELLA, new species.**

Antennæ blackish with narrow silvery white annulations; labial palpi ochreous with a rosy tint, second joint barred with black, terminal joint with two black annulations, one near the base, the other just before the tip, which is light. Face and head ochreous, strongly mottled with dark purple. Thorax dark purple. Forewing dark purple,

<sup>a</sup>Proc. U. S. Nat. Mus., XXV, 1903, p. 779.

slightly lighter toward apex and along dorsal edge; at basal third is a large oblique quadrangular yellowish white spot, reaching with one corner down over the fold; at apical third is a faint and ill-defined irregular transverse whitish line between the darker basal and the lighter apical part of the wing. In some specimens the quadrangular costal spot is continued more or less distinctly across the wing, uniting with the light dorsal edge to a broad oblique fascia; in such specimens the color of the costal spot is tinted with red. In the apical part of the wing is a more or less pronounced black longitudinal central streak, continued out into the cilia at apex. Hindwings dark fuscous; cilia with a slight rosy tint. Abdomen dark fuscous; legs ochreous barred with black; tarsal joints black with yellowish tips. Described from many specimens.

*Alar expanse*.—13 mm.

*Habitat*.—Brownsville, Texas [E. A. Schwarz and H. S. Barber]; Victoria, Texas [A. N. Caudell]; New Orleans, Louisiana [E. S. G. Titus].

*Food plant*.—Acacia.

*Type*.—Cat. No. 9765, U.S.N.M.

This species has long been unnamed in the National Museum collection in specimens bred from acacia by Mr. E. A. Schwarz; lately I have received a large series bred by Mr. Titus from acacia in New Orleans.

The larva is whitish with black head, thoracic shield and legs and with short black hairs; it feeds between the spun together leaflets, and makes its cocoon there for pupation. Mr. Titus's specimens issued in October.

The venation of this species approaches that of *Gelechia*, veins 3 and 4 in hindwings are approximate, though separate, and veins 6 and 7 are closely approximate at base instead of stalked, as is more general in the genus *Telphusa*.

In coloration it resembles *Telphusa lonafasciella* Clemens, which, however, has a white head and is a more slender, long-winged species.

**AGNIPPE EVIPPEELLA,**  
new species.

Antennæ black with narrow white annulations. Labial palpi white, sprinkled with black scales, terminal joint with a black annulation at base and another just before apex. Face silvery white. Vertex and thorax white mottled with black. Costal and apical part of

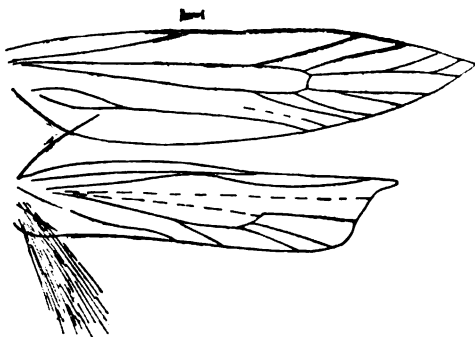


FIG. 1.—VENATION OF AGNIPPE EVIPPEELLA.

the forewings black, slightly sprinkled with white scales, especially the apical part; dorsal part below the fold white, slightly sprinkled with dark scales. The black part protrudes down into the white part with two triangular lobes. At apical third is an ill-defined white costal spot. Cilia white dusted with black. Hindwings dark fuscous. Abdomen fuscous above, silvery below. Legs white, barred with black; tarsi annulated with black.

*Expanse*.—8 mm.

*Type*.—Cat. No. 9766, U.S.N.M.

This is the only species belonging to this genus outside of Chambers's two original species which is known to me. In coloration it suggests Chambers's genus *Evippe*, or maybe still more *Recurvaria dorsitella* Zeller, but it has the very characteristic venation of *Agnippe*, lacking vein 11 in the forewing.

#### NUMATA, new genus.

Labial palpi long, recurved, smooth; second joint slightly thickened, terminal joint shorter than second. Antennæ rather thick, serrate toward the tip. Forewings narrow, elongate ovate, apex pointed; 11 veins, vein 8 absent, 6 and 7 stalked, the one to costa the other to termen, 4 and 5 stalked, 1<sup>b</sup> furcate at base. Hindwings narrower than forewings, 7 veins, vein 6 absent and transverse vein between 5 and 7 obsolete; veins 2, 3, 4, and 5 separate.

The genus is a curious development from the *Aristotelia* group.

*Type of genus*.—*Numata bipunctella* Busck.

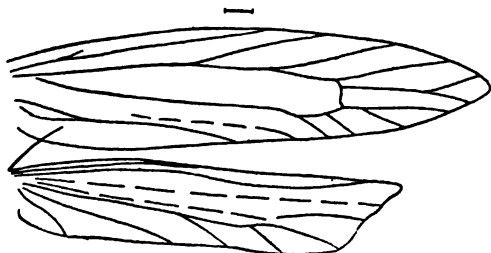


FIG. 2.—VENATION OF *NUMATA BIPUNCTELLA*.

#### NUMATA BIPUNCTELLA, new species.

Antennæ yellowish fuscous. Labial palpi straw yellow, second joint blackish on the exterior side. Face, head, and thorax light straw-yellow. Forewings

whitish straw-yellow, slightly darker toward apex, sparsely sprinkled with dark brown atoms and with two conspicuous black dots, one on the middle of the cell and the other at the end of the cell.

Abdomen and legs whitish, tarsal joints smoky.

*Alar expanse*.—Male, 9 mm.; female, 11 mm.

*Habitat*.—Brownsville, Texas, June (Barber coll.).

*Type*.—Cat. No. 9767, U.S.N.M.

#### ARISTOTELIA ELEGANTELLA (Chambers).

*Aristotelia elegantella* CHAMBERS, Dyar Cat. N. Am. Lep., No. 5582.

Two specimens.

**ARISTOTELIA RUBIDELLA** (Clemens).*Aristotelia rubidella* CLEMENS, Dyar Cat. N. Am. Lep., No. 5578.

Five specimens.

**EVIPPE POLLOSTELLA**, new species.

Antennæ light fuscous with narrow black annulations. Labial palpi silvery white, second joint with five black bars on the exterior side, terminal joint with tip and an annulation around the middle black. Face and head iridescent white, somewhat sprinkled with dark fuscous scales. Thorax ochreous fuscous. Forewings with ochreous white ground color heavily overlaid with dark fuscous scales, which in some places aggregate into blackish spots irregularly sprinkled over the wing.

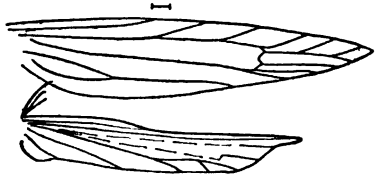


FIG. 3.—VENATION OF EVIPPE POLLOSTELLA

Cilia ochreous. Hindwings dark fuscous with ochreous cilia. Abdomen blackish, each joint tipped with silvery scales. Legs ochreous white, silvery; tarsi with black annulations.

*Alar expanse*.—5.5–6 mm.*Habitat*.—Brownsville, Texas (Barber).*Type*.—Cat. No. 9768, U.S.N.M.

This is the minutest Gelechiid I have met with and by its size alone easily separated from any described American species. Due to this extreme small size veins 4 and 5 in the forewings, which in the other species of the genus are connate or stalked, are in this species united altogether making the wing thus have only 11 veins. All the other points of generic value agree closely with the other species, and I have no hesitation about referring it to the present genus, the venation of which should therefore be corrected to: Veins 4 and 5 connate, stalked or united.

**RECURVARIA ELACHISTELLA**, new species.

Antennæ ochreous, with narrow black annulations. Labial palpi whitish ochreous, second joint somewhat mottled with black exteriorly, terminal joint with a black annulation around the middle and one just before the tip. Face silvery white. Head and thorax ochreous. Forewings light silvery ochreous, somewhat darker along the costal edge and toward apex. There are six small dots of blackish raised scales in two longitudinal rows, the upper through the middle of the wing, the under on the fold. Hindwings light fuscous, cilia ochreous. Abdomen light ochreous. Legs whitish ochreous, hind tibiae mottled with black exteriorly; tarsi unmarked.

*Alar expanse*.—7–8 mm.

*Habitat*.—Brownsville, Texas (Barber).

*Type*.—Cat. No. 9769, U.S.N.M.

Rivaled in small size among American *Gelechiid* only by *Evippe pollustella*, described above and by *Phthorimæa minor*.

The forewings have the thickened costal membrane between and around veins 9–11, found in several of the species of this genus strongly developed. Vein 2, which is normally very short in the genus, is on account of the small size obsolete in this species.



FIG. 4.—VENATION OF RECURVARIA ELACHISTELLA.

Hindwings of the male with a tuft of long hairs at the base of costa and another heavier pencil from the upper side of the dorsal base; between these

is yet another small but dense pencil of yellow hairs curiously twisted into the shape of a question mark.

#### EPITHECTIS SUBSIMELLA (Clemens).

*Epithecis subsimella* CLEMENS, Dyar. Cat. N. Am. Lep., No. 5611.

Two specimens.

#### PTHORIMÆA OPERCULELLA (Zeller).

*Phthorimæa operculella* ZELLER, Dyar. Cat. N. Am. Lep., No. 5616.

Five specimens.

#### PTHORIMÆA MINOR, new species.

Antennæ ochreous fuscous, with narrow black annulations. Labial palpi light ochreous, second joint with a black spot on the exterior side, terminal joint with two black annulations. Face ochreous white, iridescent. Head and thorax ochreous. Forewings light ochreous evenly overlaid with dark brown scales and with thin indistinct ochreous longitudinal streaks. Hindwings dark fuscous, cilia ochreous. Legs ochreous, barred with black on the exterior side; tarsi black with tip of each joint ochreous.

*Alar expanse*.—7 mm.

*Habitat*.—Brownsville, Texas. (Barber.)

*Type*.—Cat. No. 9770, U.S.N.M.

This species looks like a diminutive *Phthorimæa operculella*, having very nearly the same color and ornamentation, but it is only half the size of the smallest specimen of *operculella*.

## POLYHYMNO SEXSTRIGELLA Chambers.

*Polyhymno sexstrigella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 5649.

Six specimens. These are the first specimens of this elegant species, which have come to the National Museum collection since the unique specimen there, named by Lord Walsingham.

## UNTOMIA, new genus.

Labial palpi long, recurved; second joint somewhat thickened with smoothly appressed scales cut off sharply at the end of the joint; terminal joint smooth, pointed, longer than second joint. Antennæ simple, rather thick; forewings elongate ovate, obtusely pointed, with 11 veins, vein 8 lacking; 7 to costa 6 separate, veins 3 and 4 stalked, 1<sup>o</sup> furcate at base. Hindwings as wide as forewing, broadest at tornus, apex produced, pointed; termen sharply emarginated below apex; 8 veins, 3 and 4 connate from corner of cell, 5 curved upward from the same point, 6 and 7 connate, 7 to apex, 2 distant from 3 and 4 and the transverse vein between 5 and 7 obsolete.

The genus is a development from *Gelechia* on the lines of *Approerema*, from which it differs mainly in the more specialized venation, the absence of vein 8 and the stalking of veins 3 and 4 in the forewing and the open cell in the hindwing.

*Type of genus.*—*Untomia untomiella*.

## UNTOMIA UNTOMIELLA, new species.

Labial palpi on the exterior side blackish brown, second joint with apex white, inner side light fuscous. Antennæ dark fuscous. Face whitish, head and thorax purplish fuscous. Forewings dark fuscous, irregularly and sparsely sprinkled with ochreous and blackish scales; on the middle of the cell is a longitudinal black dot, at the end of the cell is another more prominent black dot. At the beginning of the dorsal cilia is an outwardly directed oblique narrow white streak, nearly parallel with the edge of the wing and reaching nearly to apex where it is met by a similar costal white streak; both of these are often more or less incomplete and faint and the small size of the insect makes the ornamentation obscure. The insect looks like a diminutive *Approerema concinnusella* Chambers.

*Alar expanse.*—8–9 mm.

*Habitat.*—Brownsville, Texas. (Barber) June.

*Type.*—Cat. No. 9771, U.S.N.M.

Described from a very large series, collected at light.

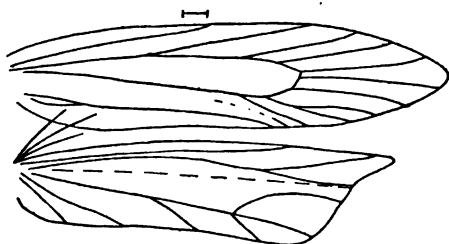


FIG. 5.—VENATION OF UNTOMIA UNTOMIELLA.

**GELECHIA LINDENELLA** Busck.

*Gelechia lindenella* Busck, Dyar, Cat. N. Am. Lep., No. 5784.

Eight specimens; the first received at the National Museum since the species was described. The locality is given in Dyar's list as *Colorado*, but should be *Texas*, whence the types came. Additional localities are given in my paper in 1903.<sup>a</sup>

**GELECHIA OBSCUROSUFFUSELLA** Chambers.

*Gelechia obscurosuffusella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 5772.

Two specimens. These are the first specimens of this species I have met with outside of Chambers' types in U. S. National Museum and in Prof. C. H. Fernald's collection; both of these are in very poor condition.

Fresh specimens enable me to add the following to Chambers' description: Extreme base of costa is black, and there is a very indistinct ocellate spot at the end of the cell, black, with white edging.

**GLYPHIDOCERA ÆQUEPULVELLA** (Chambers).

*Glyphidocera æquepulvella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 5674.

Four specimens, which are slightly darker in color than Chambers' types, and which may ultimately prove a different species, are at present most profitably determined as this species. Chambers remarks<sup>b</sup> that there is some variation in his specimens, and<sup>c</sup> that he may have two species confused under this name. Additional material of these rather obscurely marked forms is necessary to straighten this out finally.

**Family OECOPHORIDÆ.****ETHMIA SEMIOMBRA** Dyar.

*Ethmia semiombra* DYAR, Dyar Journ. N. Y. Ent. Soc., X, 1903, p. 206.

One specimen. The type of the species came from this same locality.

**TAMARRHA**, Walker.

*Tamarrha* WALKER Cat. Lep. Het. Br. Mus., XXIX 1864, p. 816.

This genus was erected for two West Indian species, *gelidella* Walker and *niveosella* Walker; no tangible generic characters were given by Walker. In 1891 Lord Walsingham<sup>d</sup> made the genus synonymous with *Pæcadia* (Ethmia), including both species under that genus; but in 1897 he<sup>e</sup> resurrected the genus in these words:

In my previous paper I sunk the genus *Tamarrha* Walker as a synonym of *Pæcadia* Hübner. In this I was guided by the neuration of *Tamarrha gelidella* Walker, which is a true *Pæcadia*. At the time I had seen only the type of Walker's other species,

<sup>a</sup> Proc. U. S. Nat. Mus., XXV, 1903, p. 876.

<sup>b</sup> Can. Ent., VI, 1874, p. 231.

<sup>c</sup> Bull. U. S. Geol. Surv., III, 1877, p. 125.

<sup>d</sup> Proc. Zool. Soc. London, p. 527.

<sup>e</sup> Idem., p. 114.

*nivosella*, which is a female. The male of this species, however, shows a strong costal tuft of diverging hairs near the base of the hind wings, which separates it at once from *Psecadia*. It possesses veins 7 and 8 of the forewing from a common stem, a character which also somewhat misled me as to its affinities; the length of the cell, however, and the general character of the neuration, together with the roughened head, seem to indicate an alliance with the Hyponementidæ rather than with the Oecophoridæ. I would therefor revive the generic name *Tamarrha* Walker, retaining *nivosella* as the type.

The writer has only lately, during studies of the West-Indian Microlepidoptera, met with Walker's two species, and has thus become acquainted with their true generic characters, which could not be divined from either Walker's descriptions or Lord Walsingham's remarks; the synonymy of his genus *Babaiæa*<sup>a</sup> was at once evident.

I am unable to agree with Lord Walsingham that Walker's first species, *gelidella* is a true *Psecadia*; it is congeneric with *nivosella*, and is evidently the species which Zeller subsequently described as *Psecadia exornatella*.<sup>b</sup>

Lord Walsingham placed the genus *Tamarrha* in the family *Yponomeutidæ*, but I fail to find any near relation in that family, or any justification for that position. The stalked veins 7 and 8 in the forewings, both terminating in the costal edge, the hairy posterior tibiæ, the obsolete maxillary palpi, the connate veins 3 and 4 in the hindwings, and the general habitus of the species seem to place the genus in the family Oecophoridæ, in spite of the connecting vein between veins 7 and 8 in the hindwings equally heterogeneous in both families, and the consequent partial obliteration of the basal part of vein 7, which remains as pointed out in my original description the salient distinctive character of the genus.

On the other hand, the close resemblance to the genus *Ethmia* (*Psecadia*), which caused such careful workers as Zeller, Möschler, and Fernald to describe the species as members of that genus, seems to me only superficial and not indicative of close relationship.

The tufted head which Zeller mentioned as a unique character of the male of *nivosella* is not, as supposed by Lord Walsingham, a family character, equivalent to the tufted head of the *Tineidæ*. The head is probably normally smooth in both sexes, but the species seems to have the remarkable ability of raising the scales on the vertex and even on the face. In a large series of perfect specimens of *Tamarrha nivosella* before me this character is not confined to the males, and some of the specimens of both sexes exhibit as typically tufted a head as any *Tinea*, while others have the scales of the head perfectly smoothly appressed; in some specimens the face is smooth and the vertex only tufted, and in two specimens the one side of the head and face is tufted, the other side smooth, proving that it is a changeable character, probably in control of the individual and subject to the mental condition of the insect.

<sup>a</sup>Journ. N. Y. Ent. Soc., X, 1902, p. 95.

<sup>b</sup>Floræ Soc. Ent. Ross., XIII, 1877, p. 238.

## TAMARRHA BITTENELLA, new species.

Antennæ dark brown with white bases. Labial palpi white, second joint mottled with black. Face and head white. Thorax white with four bluish black dots. Patagina white. Forewings shining white with dark brown markings, which, in certain lights, appear bright metallic bluish black. Entire costal edge dark brown; a black dot on

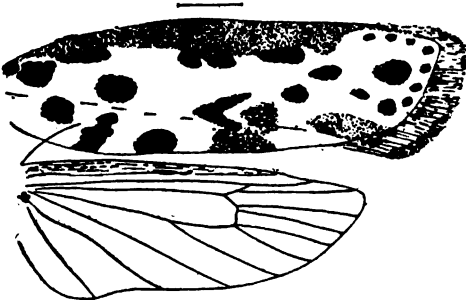


FIG. 6.—WINGS OF TAMARRHA BITTENELLA.

the fold near base; an oblique oblong dot below the fold followed by a round one, which is in turn followed by a larger oblong spot on and parallel with the dorsal edge. On the cell is a round black dot, at the end of the cell is a similar one, and in the apical part of the wing are several less regular black spots; around apical edge is a row of

black dots, more or less confluent. Cilia white, with base of apical part golden yellow. Hindwings light silvery fuscous; at the base of the costa in the males is a thin tuft of long yellow hairs. Abdomen above dark golden fuscous, below silvery, each joint tipped with golden yellow. Anterior side of all coxæ golden yellow, legs otherwise white with black markings on the exterior side; tarsi black, each joint tipped with white.

*Alar expanse*.—18–12 mm.

*Habitat*.—Brownsville, Texas (Barber), June.

*Type*.—Cat. No. 9772, U.S.N.M.

Described from a good series collected at light and by sweeping.

The species is quite similar in general appearance and color scheme to *T. deltiella* Fernald, but is smaller and readily distinguished by the dark costa and the lack of transverse lines.

The characteristic venation is identical with that of the type.

There is some slight variation in the disposition of the dark marking in the different specimens. The figure represents one common form.

## BORKHAUSENIA DETERMINATELLA (Zeller).

*Oecophora determinatella* ZELLER, Dyar Cat. N. Am. Lep., No. 5924.

Two specimens.

## Family ELACHISTIDÆ.

## SCYTHRIS IMPOSITELLA (Zeller).

*Scythris impositella* ZELLER, Dyar Cat. N. Am. Lep., No. 6110.

Three specimens.

**MOMPHA ELOISELLA** (Clemens).

*Mompha eloisella* CLEMENS, Dyar Cat. N. Am. Lep., No. 6157.

Two specimens.

**MOMPHA PUNCTIFERELLA**, new species.

Antennæ dark fuscous with indistinct lighter annulations. Labial palpi with both joints thickened with smoothly appressed scales, sharply cut off at apex; apical tip of terminal joint protruding above the scales, pointed; dark fuscous, irrorated with white transverse wavy lines. Face, head, and thorax dark gray. Forewings narrow lanceolate, dark silvery gray, evenly speckled with numerous minute tufts of black scales; on the fold is one larger black tuft of scales. Hindwings dark fuscous, cilia ochreous fuscous. Abdomen dark silvery fuscous above, underside white. Legs blackish fuscous, each tarsal joint tipped with ochreous white.

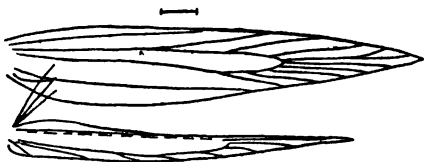


FIG. 7.—VENATION OF *MOMPHA PUNCTIFERELLA*.

*Alar expanse*.—10–11 mm.

*Habitat*.—Brownsville, Texas.

*Type*.—Cat. No. 9773, U.S.N.M.

Described from four specimens. In palpal characters and general habitus this species reminds one of *Epermenia*, but it has no dorsal scale tufts on the forewings, and the venation is typical of the present genus.

## Family TINEIDÆ.

**OPOSTEGA QUADRISTRIGELLA** Chambers.

*Opostega quadristrigella* CHAMBERS, Dyar Cat. N. Am. Lep., No. 6231.—BUSCK, Proc. Ent. Soc. Wash., V, 1903, p. 208.

One specimen.

**BUCCULATRIX NIVEELLA** Chambers.

*Bucculatrix niveella* CHAMBERS, Dyar Cat. N. Am. Lep., No. 6244.

Two specimens; the species is new to the U. S. National Museum collection.

**GRACILARIA [DIALECTICA] GUNNIELLA**, new species.

Antennæ dark purplish brown. Labial palpi silvery white, apex of terminal joint somewhat dusky. Maxillary palpi silvery white. A central longitudinal streak of face, head, and thorax yellowish white; sides of head ochreous; patagium dark purplish brown. Forewings purplish brown; between the middle of the costa and the apical third is an oblique yellowish-white costal streak, pointed toward apex and edged with black scales. Slightly outside the apical third is a narrow,

outwardly curved fascia of metallic steel blue and purple scales; touching this fascia is a small white costal spot extended out into the cilia, and between it and the apex is still another white spot in the costal cilia. The entire dorsal edge from base to the metallic fascia is yellowish white; at apex is a prominent elliptical black spot, and around the apical edge of the wing is a deep black narrow line before the light brown cilia. Hindwings dark fuscous. Abdomen yellowish fuscous; legs yellow, barred indistinctly with black on the exterior side. Posterior tibiae pectinated throughout.

*Alar expanse*.—9–10 mm.

*Habitat*.—Brownsville, Tex.

*Type*.—Cat. No. 9774 U.S.N.M.

The species is nearest, though not very close, to *Gracilaria* (*Dialectica*) *venustella*, Clemens.

#### CORISCIUM TEXANELLA, new species.

Antennæ ochreous with a bluish luster. Brush on second joint of labial palpi bluish black; terminal joint ochreous with a black spot on the exterior side. Maxillary palpi ochreous gray. Head and thorax dark gray, face a shade lighter. Forewings dark gray with a purplish luster and with short irregular longitudinal black streaks; apical part of costal edge and apex deep black with two narrow indistinct silvery white oblique costal streaks pointed toward apex and with one somewhat more prominent slightly inwardly curved white fascia just before the tip of the wing. Hindwings dark fuscous. Abdomen dark fuscous, anal segment silvery ochreous. Legs purplish black, anterior legs slightly thickened and with ochreous tarsi; posterior legs with smooth tibiae and with each tarsal joint tipped with ochreous.

*Alar expanse*.—14 mm.

*Habitat*.—Brownsville, Texas.

*Type*.—No. 9775, U.S.N.M.

Quite unlike any of our described species of this genus.

#### EUPRORA, new genus.

Face and head tufted. Antennæ 4, basal joint with large pointed flap of scales. Second joint of labial palpi with long spreading hairs above and below; terminal joint shorter than second, obtuse. Maxillary palpi rather long, folded. Forewings narrow, elongate, pointed four times as long as wide; 12 veins, 7 and 8 stalked to costa. Hindwings slightly narrower than forewings, elongate ovate; 8 veins; 2, 3, and 4 separate; 5 and 6 connate; 7 parallel with 6. Posterior tibiae long haired above.

*Type of genus*.—*Euprora argentiiniella*.

**EUPRORA ARGENTILINIELLA, new species.**

Antennæ olive brown, with two longitudinal silvery white lines through the entire length from base to tip; tuft on first antennal joint white, very sparsely sprinkled with single ochreous scales. Face and head pure white; labial palpi white, tuft on second joint slightly sprinkled with ochreous on the exterior side. The palpal and antennal tufts together form a very striking white cross when viewed from the front. Thorax golden ochreous; patagina edged with white. Forewings golden ochreous with silvery white markings; costal edge white; from base of wing run two short longitudinal white lines, one in the middle of the wing, ending in the cell; the other below the fold, reaching the dorsal edge at basal third. A slender white outwardly directed spur from the costal edge at basal fourth ends in the middle of the cell; another heavier white line from the middle of costa curves outward and downward, following the edge of the cell, and joins an opposite congruent white line from the dorsal edge. Just before apex is a small white costal spot and two apical veins (6 and 4) are indicated by silvery white lines. All of these white markings are thinly edged by sparse black scales, and the entire apical part of the wing is sparsely sprinkled with single black scales. Cilia ochreous sprinkled with black. Hindwings shining, dark ochreous fuscous. Abdomen ochreous. Legs silvery ochreous.



FIG. 8.—HEAD OF  
EUPRORA ARGENTILINIELLA.

*Alar expanse*.—17 mm.

*Habitat*.—Brownsville, Texas.

*Type*.—Cat. No. 9776, U.S.N.M.

A striking insect, described from a unique male, easily distinguished by the white head ornamentation. The position of the insect at rest will surely be found to display this character prominently in bold imitation of some of its natural surroundings.

**AMYDRIA MARJORIELLA Dietz.**

*Amydria marjoriella* DIETZ, Trans. Am. Ent. Soc., XXXI, p. 11, pl. III, fig. 5.

Twenty-five specimens.

The erection by Doctor Dietz<sup>a</sup> of a new subfamily for this and allied genera is hardly warranted. From his own synoptic table it is plain that not one single character given, nor any combination of his characters can be maintained in the separation from his other subfamily *Tineinæ*. In spite of Doctor Dietz's claim that the two "are distinct and sharply defined" by "the apparently heretofore overlooked" character the more or less distinct furcation of "vein 1*b* in the hindwings," he himself admits that this furcation occurs in *Paracle-*

<sup>a</sup>Trans. Am. Ent. Soc., XXXI, 1905, p. 2.

*mensia* Busck [Brackenridgia], which he includes in his subfamily without furcation, and I find this furcation also in other genera [*Greya* Busck, *Cyane* Chambers] placed by Doctor Dietz in that division.

#### XYLESTHIA PRUNIRAMIELLA Clemens.

*Xylestia pruniramiella* CLEMENS, Dyar, Cat. N. Am. Lep. No. 6476.

One specimen.

#### SETOMORPHA OPEROSELLA Zeller.

*Setomorpha operosella* ZELLER, Verh. k. k. zoo. bot. Gesell. Wien, XXIII, 1873, p. 223.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 162.—DYAR, Cat. N. Am. Lep., 1903, No. 6549.

*Setomorpha inamoenella* ZELLER, Verh. k. k., zoo. bot. Gesell. Wien, XXIII, 1873, p. 224.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 162.—DYAR, Cat. N. Am. Lep., 1903, No. 6550.

*Setomorpha ruderella* ZELLER, Verh. k. k. zoo. bot. Gesell. Wien, XXIII, 1878, p. 225.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 162.—DYAR, Cat. N. Am. Lep., 1903, No. 6551.

*Gelechia multimaculella* CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 89.—HAGEN, Papilio, IV, 1884, p. 99.—RILEY, Smith, List Lep. Bor. Am. 1891, No. 5414.

*Plutella* (?) *multimaculella* BUSCK, Journ. N. Y. Ent. Soc., X, 1902, p. 97.—DYAR, Cat. N. Am. Lep., 1903, No. 5509.

*Semiota operosella* DIETZ, Trans. Am. Ent. Soc. Phil., XXXI, 1905, p. 18.

*Semiota inamoenella* DIETZ, Trans. Am. Ent. Soc. Phil., XXXI, 1905, p. 19.

As pointed out by Snellen,<sup>a</sup> the two sexes of Zeller's genus *Setomorpha* have different venation, the males lacking vein 4 in both anterior and posterior wings, while the females possess this vein in both wings.

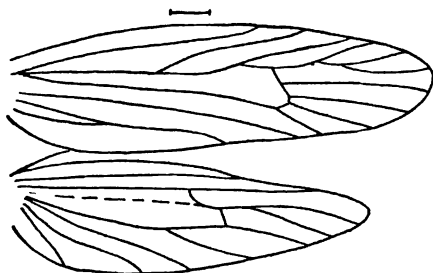


FIG. 9.—VENATION OF SETOMORPHA OPEROSELLA, MALE.

male, he did not make out its different venation and included it in his new genus. This genus *Semiota* Dietz with *inamoenella* as type must consequently fall.

Zeller says, "die beiden Geschlechter auch der americanischen Arten in Grösse sehr verschieden zu sein scheinen," but nevertheless he makes one species for the male and another for the female. Zeller evidently

<sup>a</sup> Tidsch. voor Entom., 1884, p. 25.

<sup>b</sup> Trans. Am. Ent. Soc. Phil., XXXI, p. 18.

<sup>c</sup> Verh. k. k. zool., bot. Gesell., Wien., XXIII, 1878, p. 223.

did this on second thought and after first having considered them conspecific; this is plain from his remark above quoted, taken in connection with the fact that he had only a unique of each of the species before him. I must admit that, as long as I knew the species from Zeller's types only, I supposed there were two species on account of the considerable difference in size of the two sexes, which is quite uncommon in the Tineinæ; but now, with ample material before me, of which all the large specimens (*operosella*) are females and all the small specimens (*inamoenella*) are males, it is easy to draw the conclusion concerning the synonymy. The two names apply to the two sexes of the same species.

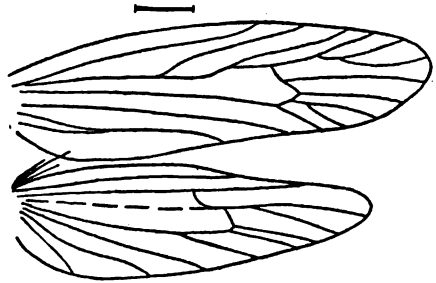


FIG. 10.—VENATION OF *SCTOMORPHA OPEROSELLA*, FEMALE.

Chambers's type in the Museum of Comparative Zoology, Cambridge, of *Gelechia multimaculella* is a male of this same species.

While on the subject of Doctor Dietz's paper on this group I may point out that some of his generic names are preoccupied, and I propose the following names to take their place:

*Hypoplesia* instead of *Paraplesia* Dietz, not Felder; type: *busckiella* Dietz.

*Mea* instead of *Progona* Dietz, not Berg; type: *skinnerella* Dietz.

*Dietzia* instead of *Abacobia* Dietz, not *Abacobius* Lacordaire; type: *carbonella* Dietz.

#### TINEA NIVEOCAPITELLA Chambers.

*Tinea niveocapitella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 6516.—DIETZ, Trans. Am. Ent. Soc. Phila., XXXI, 1905, p. 55.

One specimen. No authentic specimen of this species is extant, but I identify with but little hesitancy the present specimen from Chambers' description, with which it fully agrees. Chambers' type came from California, but the different locality is hardly of sufficient importance in this genus to make the determination hazardous.

#### TINEA CROCEOVERTICELLA Chambers.

*Tinea croceoverticella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 6500.—DIETZ, Trans. Am. Ent. Soc. Phila., XXXI, 1905, p. 54.

One specimen. This is somewhat larger than Chambers's measure, but, considering the variability in size commonly found in this genus, I have no hesitation about referring it to this species.

Doctor Dietz has in his index by mistake made a synonym by referring to this species as *croceocapitella*.

**TINEA FUSCOPULVELLA** Chambers.

*Tinea fuscopulvella* CHAMBERS, Dyar, Cat. N. Am. Lep., No. 6505.—DIETZ, Trans. Am. Ent. Soc. Phila., XXXI, 1906, p. 70.

One specimen; the species is new to the U. S. National Museum collection.

**EULEPISTE CRESSONI** Walsingham.

*Eulepiste cressoni* WALSINGHAM, Dyar, Cat. N. Am. Lep., No. 6579.

One specimen.

**EULEPISTE MACULIFER** Walsingham.

*Eulepiste maculifer* WALSINGHAM, Dyar, Cat. N. Am. Lep., No. 6579.

One specimen; this is the first time this species has been received by the U. S. National Museum since Lord Walsingham's original type specimen.

**ACROLOPHUS CERVINUS** Walsingham.

*Acrolophus cervinus*, WALSINGHAM, Dyar, Cat. N. Am. Lep., No. 6585.

Two specimens.

**ACROLOPHUS CONFUSELLA** Dyar.

Two specimens.

**ACROLOPHUS HULSTELLUS** Beutenmüller.

*Acrolophus hulstellus* BEUTENMÜLLER, Dyar, Cat. N. Am. Lep., No. 6587.

Several specimens.

**ANAPHORA POPEANELLA** Clemens.

*Anaphora popeanella* CLEMENS, Dyar, Cat. N. Am. Lep., No. 6594.

Two specimens.

**HYPOCLOPUS GRISEUS** Walsingham.

*Hypoclopus griseus* WALSINGHAM, Dyar, Cat. N. Am. Lep., No. 6582.

Four specimens.

**HYPOCLOPUS MORTIPENNELLA** (Grote).

*Hypoclopus mortipennella* GROTE, Dyar, Cat. N. Am. Lep., No. 6583.

Several specimens.

## NOTES ON MALAYAN PIGS.

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By GERRIT S. MILLER, Jr.,  
*Assistant Curator, Division of Mammals.*

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The U. S. National Museum contains 62 Malayan pigs (51 skins and 62 skulls) presented by Dr. W. L. Abbott. This collection, especially rich in local species of the *Sus vittatus* group, was made in the region extending from the Natuna Islands on the east to the Nicobar and Andaman Islands on the west, and from Tenasserim and the Mergui Archipelago on the north to Engano on the south. Four particularly interesting specimens from Johore have also been contributed by Mr. C. B. Kloss. Although this material has been gradually accumulating for nearly ten years, I have been able to publish very little concerning it, owing to lack of information with regard to the exact status of some of the earlier-described Malayan species. During a recent visit to Europe I was enabled, through the courtesy of the directors of the various institutions, to examine the collections of pigs in the Natural History Museum in Berne, the Natural History Museum and Agricultural High School in Berlin, the Natural History Museum in Leyden, and the British Museum in London. Observations on all of this material form the subject of these notes.

### I.—THE *SUS BARBATUS* GROUP.

Much confusion has existed with regard to the members of the *Sus barbatus* group occurring in Borneo and Sumatra, some authors supposing that there are three species, others that there is only one. This is the result not so much of the lack of specimens as of the circumstance that each writer has worked separately and without consulting the material studied by others. The series that I have examined show that the two islands are inhabited by at least three species, but that the status of these forms has hitherto been very imperfectly understood.

The first member of the group to be made known, the Bornean *Sus barbatus*, was briefly described in 1839<sup>a</sup> by Müller, who subsequently<sup>b</sup>

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<sup>a</sup>Tijdschrift voor Natuurlijke Geschiedenis en Physiologie, V, p. 149.

<sup>b</sup>Verhandel. over de Natuurlijke Geschiedenis der Nederl. overzeesche Bezittingen, Zoologie, p. 179, pls. xxx and xxxi.

published a more detailed account of the animal with figures of the skull and of an adult female. Certain peculiarities, probably artificial, of the type specimen were the source of much confusion in the later literature. In 1868<sup>a</sup> Gray made this species the type of a new subgenus, *Eumus*, a name which he afterward<sup>b</sup> changed to *Euhys*, eventually<sup>c</sup> raising the group to generic rank. Nothing more of special importance was published until 1885, when Nehring recognized two species among specimens from southern Borneo, a "gigantic" animal which he considered the same as Müller's *Sus barbatus*, and an animal of less extraordinary size to which he applied the new name *Sus longirostris*.<sup>d</sup> The distinctness of the two species he also clearly showed in several later papers.<sup>e</sup> In 1894 a third generic name, *Rhinosus*, was applied to the group.<sup>f</sup> Although not dealing specially with the Bornean and Sumatran species, Dr. Forsyth Major's paper "On *Sus verrucosus* Müll. & Schleg., and Allies, from the Eastern Archipelago"<sup>g</sup> contains some important data bearing on the distinctness of the two Bornean forms. In 1902 I described a Sumatran representative of *Sus barbatus*, the local form of Nehring's smaller animal, as *Sus oi*.<sup>h</sup> This well-characterized species, together with Nehring's even more conspicuously differentiated Bornean form, were subsequently regarded as identical with *Sus barbatus* by Volz, in a very elaborate paper on Sumatran pigs.<sup>i</sup> More recently, however, Dr. F. A. Jentink<sup>j</sup> has recognized the distinctness of the three animals, and has pointed out that much of the confusion has arisen from the fact that Nehring wrongly identified as *Sus barbatus* his larger animal. Doctor Jentink suggests that this skull is that of "an unknown very large Borneo pig," a conclusion at which I had arrived on seeing the specimen nearly a year before.

The members of this group are large animals, full-grown males weighing 110 kg. or more; the body is high and very narrow, scantily haired in the adult, the head greatly elongated, the cheeks heavily bearded; about midway between eye and nostril there is on each side of the muzzle a warty outgrowth covered with stiff antrorse bristles, large and conspicuous in males, less noticeable in females, though never absent, even in the very young. Skull with rostral

<sup>a</sup>Proc. Zool. Soc., London, p. 32.

<sup>b</sup>Catal. Carniv. Pachyderm. and Edentate Mamm., Brit. Mus., 1869, p. 339.

<sup>c</sup>Ann. and Mag. Nat. Hist., 4th ser., XI, p. 435, June, 1873.

<sup>d</sup>Zool. Anzeiger, VIII, p. 347, June 15, 1885.

<sup>e</sup>Sitz.-Ber. Gesellsch. naturforsch. Freunde zu Berlin, 1886, pp. 80-85; Abhandl. u. Ber. zool. anthrop.-ethnogr. Mus., Dresden, 1888-1889, pp. 1-34; Sitz.-Ber. Gesellsch. naturforsch. Freunde zu Berlin, 1889, p. 196.

<sup>f</sup>Heude, Mém. concernant l'Hist. Nat. de l'Emp. Chinois, II, p. 213 (footnote).

<sup>g</sup>Ann. and Mag. Nat. Hist., 6th ser., XIX, pp. 521-542, May, 1897.

<sup>h</sup>Proc. Biol. Soc. Washington, XV, p. 51, March 5, 1902.

<sup>i</sup>Zool. Jahrbücher, Abth. Syst., XX, pp. 509-540, pl. xviii, July 16, 1904.

<sup>j</sup>Notes from the Leyden Museum, XXVI, pp. 155-171, October 16, 1905.

portion so long that the distance from middle of interorbital space to tip of nasals is considerably more than twice that from interorbital space to occipital crest; parietal region narrowing to a ridge in fully adult individuals; interpterygoid space not extending forward between palatines; mandibular tusk of male with outer face nearly as wide as inner and about one and one-half times as wide as posterior face.

While these characters appear to circumscribe the group very definitely, at least so far as the Bornean and Sumatran species are concerned, their taxonomic importance, as well as the question whether *Eusus* should be recognized either as a subgenus or genus, can be properly discussed only in connection with a general revision of the Malayan pigs. The members of the *barbatus* group are confined, so far as is now known, to the islands of the Malay Archipelago. The range of one species, however, extends to Batam Island, close to the southern extremity of the Malay Peninsula. The three known Bornean and Sumatran forms may be distinguished as follows:

KEY TO THE BORNEAN AND SUMATRAN REPRESENTATIVES OF THE *SUS BARBATUS* GROUP.

- Upper length of skull in adult male 570 mm. (probably often more); occiput produced conspicuously behind foramen magnum ..... *Sus gargantua*, p. 743.  
 Upper length of skull in adult male 460–510 mm.; occiput scarcely produced behind foramen magnum.  
 Third lower molar with three cross ridges and a terminal heel... *Sus barbatus*, p. 739.  
 Third lower molar with two cross ridges and a terminal heel..... *Sus oi*, p. 741.

**SUS BARBATUS Müller.**

Plates XXXIX, XLII, XLV, XLVIII, XLIX, and LI.

1839. *Sus barbatus* MÜLLER, Tijdschrift voor Natuurlijke Geschiedenis en Physiologie, V, p. 149.  
 1839–44. *Sus barbatus* MÜLLER and SCHLEGEL, Verhandel. over de Natuurlijke Geschiedenis der Nederl. overzeesche Bezittingen, zoologie, p. 179, pls. xxx, xxxi.  
 1885. *Sus longirostris* NEHRING, Zool. Anzeiger, VIII, p. 347, June 15, 1885.  
 1888. *Sus longirostris* NEHRING, Abhandl. u. Berichte des kgl. zool. u. anthrop.-ethnogr. Mus. zu Dresden, 1888–1889, p. 18, figs. 13 and 14.  
 1902. *Sus longirostris* MILLER, Proc. Biol. Soc. Washington, XV, p. 51, March 5, 1902.  
 1904. *Sus barbatus* VOLZ, Zool. Jahrbücher, Abth. Syst., XX, p. 518, July 18, 1904 (part).  
 1905. *Sus barbatus* JENTINK, Notes from the Leyden Museum, XXVI, p. 161, pls. II, v, October 16, 1905.

*Type locality*.—Banjermassing, southern Borneo.

*Geographic distribution*.—Borneo; Java?<sup>a</sup>

*Characters*.—Upper length of skull of adult male, 440–490 mm.; occipital region bent upward so that lower edge of condyle is consid-

<sup>a</sup> Doctor Volz has shown (Zool. Jahrb. Abth. Syst., XX, pp. 535–536) that the occurrence of this animal in Java is doubtful.

erably above level of alveolar line, and posterior overhang of occiput is only about one-fourth occipital height through condyle (see fig. 1); ratios to basal length: of profile length, about 117; of height of skull when resting on mandibles, about 60; posterior molar both above and below long, the upper tooth containing a compressed anterior median ridge, a middle median ridge, and a large terminal median heel in addition to two well-developed bicusped cross ridges, the lower tooth containing three large bicusped cross ridges and three smaller median ridges, the last of which forms the terminal heel (Plate XLIX, fig. 1.)

*Measurements.*—For measurements see table, pages 755 and 756.

*Specimens examined.*—Twenty-seven skulls of adults and two mounted specimens from the following localities: Borneo, Banjer-massing, 2 (1 mounted; Leyden); southeastern Borneo, 4 (Berlin, High School); Darvel Bay, 11 (Berlin, Museum); Maruda Bay, 2 (Berlin, Museum); Marude, Sarawak, 1 (British Museum); Baram, 3 (British Museum); near Sandakan (skull and mounted skin; U. S. National Museum); no exact locality, 1 (British Museum); Java, no exact locality, 2 (Leyden).

*Remarks.*—The series of skulls examined show that the cranial and dental characters of *Sus barbatus* are not subject to any remarkable variation. The upper length in adult males ranges from 450 to 490 mm., the larger skulls occurring among the older individuals. The zygomatic breadth ranges from 156 to 178 mm. The principal variations in form are due to the greater or less angle in the facial profile at posterior extremity of nasals and to slight differences in the width of the rostrum. The Javan skulls show no appreciable differences from the Bornean specimens.<sup>a</sup> The type of *Sus longirostris* agrees perfectly with the other skulls except for two slight peculiarities: The zygoma below and in front of orbit is distinctly concave instead of swollen and convex, and the edge of the ridge above tusks is more noticeably thickened and turned inward than in any other specimen that I have seen.

In the type of *Sus barbatus* (an adult female) the protuberances on the muzzle can scarcely be detected. Their position is, however, clearly indicated by the usual tufts of bristles, and without doubt their apparent absence is due to the treatment that the skin received in the process of mounting. This peculiarity of the original specimen is responsible for much of the confusion which has arisen with regard to the specific characters of the members of this group. It caused Müller to overlook the protuberances in describing *Sus barbatus*, and hence led Nehr-

<sup>a</sup> Their similarity to specimens from Borneo is so perfect as to suggest that they may have been taken in that island. Diard worked in both Java and Borneo and obtained *Sus barbatus* near Pontianak (see Jentink, Notes from the Leyden Museum, XXIV, p. 164). It is therefore by no means impossible that an error in labeling may have occurred.

ing to regard the presence of these structures as one of the most important characters of *Sus longirostris*, an error which is repeated in my account of *Sus oi*.

#### SUS OI Miller.

Plates XL, XLIII, XLVI, XLIX, LII, and LXIII.

1902. *Sus oi* MILLER, Proc. Biol. Soc. Washington, XV, p. 51, March 5, 1902.

1904. *Sus barbatus* VOLZ, Zool. Jahrbücher, Abth. Syst., XX, p. 518, pl. xviii, July 16, 1904 (part).

1905. *Sus oi* JENTINK, Notes from the Leyden Museum, XXVI, p. 165, pls. iii, iv, and v, October 16, 1905.

*Type locality*.—Indragiri River, eastern Sumatra.

*Geographic distribution*.—Eastern Sumatra; Rhio Archipelago (Pulo Kundur<sup>a</sup>); Banka.

*Characters*.—Upper length of skull of adult male 460–505 mm.; general form of skull as in *Sus barbatus*; last molar both above and below smaller than in the Bornean animal, the upper tooth retaining all its elements, but with its posterior portion much narrowed, the lower tooth (Plate XLIX, fig. 3) lacking the terminal heel, but with the third transverse ridge reduced to a terete heel-like remnant (see also the figure published by Volz).<sup>b</sup>

*Measurements*.—For measurements, see table, pages 755 and 756.

*Specimens examined*.—Nine, from the following localities: Indragiri River, Sumatra, 1; Palëmbang, Sumatra, 2 (Berne); Banka Island, 4; Pulo Kundur, Rhio Archipelago, 2.

*Remarks*.—This species is distinguishable from *Sus barbatus* chiefly by the reduced size and complexity of the posterior lower molar, a character shown by the type and by one of Doctor Volz's Palembang specimens, the only adults yet known with this tooth in good condition. No tendency toward a similar reduction could be detected in any of the twenty-seven adults of *Sus barbatus* that I have examined. It is very probable that, as Doctor Jentink states, the skull is more elongated than in the Bornean animal. Though the material thus far

<sup>a</sup>Though Pulo Kundur is the only island of the Rhio Archipelago from which specimens have been examined, the animal probably occurs throughout the group wherever sufficiently extensive forests remain. In a letter dated April 21, 1904, Doctor Abbott writes: "*Sus oi* is found on the other islands of the Rhio Archipelago. A watchmaker named Maw here in Singapore, who is a great shikari, told me that they got four—one big boar, a sow, and two smaller pigs—a few Sundays ago over on Pulo Batam, opposite Singapore, behind the little island Nongsa. He had never seen them before and did not know what they were. They put the four carcasses into a sampan and started to tow them to Singapore by their lannel. But the sampan capsized and all were lost." In a more recent letter (May 14, 1904) he adds that seven of these pigs instead of four were killed on Pulo Batam, and that Maw has never seen the animal in the neighborhood of Singapore, although he has been shooting there for many years.

<sup>b</sup> Zool. Jahrb., Abth. Syst., XX, pl. xviii, July 16, 1904.

collected is hardly sufficient to demonstrate this, the circumstance that one of the three known adult skulls of *Sus oi* is longer than any among twenty-seven of *Sus barbatus* strongly suggests that such is the fact.

The seven skins collected by Doctor Abbott show no very striking variations other than those due to age. The youngest specimen, a male from Pulo Kundur, with head and body 860 mm. in length (No. 122930), is a uniform blackish brown throughout, the skin fairly well covered by hair, except about ears and along median portion of underparts, most of the hairs tipped with dull ochraceous buff, but this color quite inconspicuous except along middle of back and neck, where, particularly on neck, it forms almost a light median stripe. The hairs along ridge of back and neck are lengthened to form a slight mane. Face uniformly covered with short, soft, unmodified blackish hairs, which scarcely conceal the skin. Rostral protuberances distinct, almost naked, about the size of small peas. The next stage is represented by the four skins from Banka—a female (No. 124761) 1,090 mm. in length (head and body), and three males (No. 124716, No. 124760, and No. 124908), ranging from 1,100 to 1,230 mm. In each of these the body is less thickly haired than in No. 122930, though sufficiently clothed to give the animal a blackish appearance. Light tips to the hairs occur very generally in three of the skins, but in the fourth they are practically confined to the short and inconspicuous mane. In the female and two of the males the beard is well developed, causing the head to appear much more hairy than the body. It is further made conspicuous by the strong contrast of its light color with the blackish body. In the third male (No. 124716) it is partly grown. In all four the bristles hide the rostral protuberances, which, however, are readily appreciable to the touch. Muzzle and forehead blackish, in marked contrast with light beard. The female from Pulo Kundur (No. 122869), with head and body 1,330 mm. in length, though essentially like the smaller individuals, appears lighter in color on account of the more sparse coat. There is a thin though noticeable mane along neck and anterior half of back. Finally, in the type, a young adult male (head and body 1,575 mm.), the general effect is that of a naked, yellowish animal, with the body rather thickly sprinkled with blackish bristles, the light tips of which are scarcely noticeable on account of their close similarity to the color of the skin. The body of this animal is much more scantily haired than in either of the two adults of *Sus barbatus* that I have examined. (See Plates LI and LII.) Only on the cheeks, face, and throat is the hairy covering complete.

**SUS GARGANTUA, new species.**

Plates XLI, XLIV, XLVII, XLVIII, XLIX, and L.<sup>a</sup>

1885. *Sus barbatus* NEHRING, Zool. Anzeiger, VIII, p. 347, June 15, 1885. (Not *Sus barbatus* Müller.)

1888. *Sus barbatus* NEHRING, Abhandl. u. Berichte des kgl. zool. u. anthrop.-ethnogr. Mus. zu Dresden, 1888-1889, p. 21, fig. 15. (Not *Sus barbatus* Müller.)

1904. *Sus barbatus* VOLZ, Zool. Jahrbücher, Abth. Syst., XX, p. 518, July 16, 1904. (Part.)

1905. [*Sus* sp.] JENTINK, Notes from the Leyden Museum, XXVI, p. 160, October 16, 1905.

*Type specimen*.—Young adult male (skull only) No. 4066, Agricultural High School, Berlin. Collected in southeastern Borneo in 1882 by Grabowsky.

*Geographic distribution*.—Southeastern Borneo.

*Characters*.—Upper length of skull of young adult male about 570 mm. (in old individuals probably more); occipital region so low that

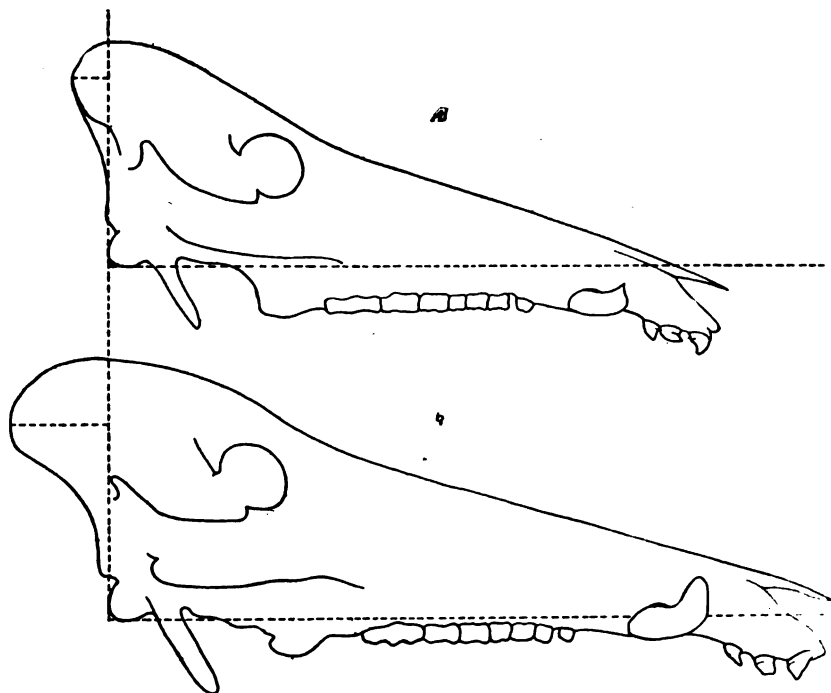


FIG. 1.—DIAGRAMMATIC COMPARISON OF SKULLS OF *Sus barbatus* (A) AND *Sus gargantua* (B).

edge of condyle is scarcely above level of alveolar line, and so pro-

<sup>a</sup> For the photographs of the type skull and for permission to publish them I am indebted to Prof. Paul Matschie of the Natural History Museum, Berlin, and to the authorities of the Agricultural High School of the same city.

duced backward that posterior overhang is nearly one-half occipital height through condyle (see fig. 1); ratios to basal length:<sup>a</sup> of profile length, 123.1; of height of skull when resting on mandibles, 53.8; teeth essentially as in *Sus barbatus*. (Plate XLIX, fig. 2, and Plate L.)

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—One, the type.

*Remarks*.—This strikingly characterized species, the largest known living pig, is at once recognizable by the great size of the skull and by the conspicuously low, overhanging occipital region. As the type is a young adult with teeth even less worn than in the type of *Sus oi*, and with the basioccipital suture open (in the type of *Sus oi* it is closed), it is not unreasonable to expect that in aged individuals the skull will be found to reach the enormous length of 600 mm. The exact difference in form between the skull of *Sus gargantua* and that of *Sus barbatus* and *Sus oi*, though readily appreciable to the eye is not easy to describe. If the occipital region in the smaller animals were to be drawn backward and downward until the condyle nearly reached the level of the alveolar line, it would require only a slight further increase in the backward projection of the occiput to give the skull approximately the form that it has in the larger species. In both the ratio of occipital height through condyle to length of skull is about as 1 to 3, though it is slightly more in the smaller than in the larger type. The less relative height of the skull of *Sus gargantua* when resting on the mandibles is therefore chiefly due to the less relative elevation of the condyle above the under surface of the lower jaw. (See Plate XLVIII.)

## II.—THE *SUS CRISTATUS* GROUP.

It has long been known that pigs resembling *Sus cristatus* inhabit the Malay Peninsula, but apparently no critical comparison has recently been made between these animals and the true *Sus cristatus* of India. There are fifteen skins and sixteen skulls in the U. S. National Museum collected by Doctor Abbott on the west side of the peninsula, and also two from Johore presented by Mr. C. B. Kloss. Comparison of this material with two specimens of *Sus cristatus* in the same museum and of one of the Abbott skulls with the extensive series of Indian specimens in the British Museum, shows that the Malayan pigs are not *Sus cristatus*, and that among them are represented at least two local forms.

The members of this group are rather large animals, with the general appearance of the European wild boar, to which they are closely related. The face is without special warty outgrowths or peculiar developments of hair, though the bristles on chin and beneath jaws are occasionally much elongated. The body is covered with coarse hair that nearly or quite conceals the skin, even in fully adult animals;

<sup>a</sup> Major, Ann. and Mag. Nat. Hist., 6th ser., XIX, May, 1897, pp. 540-541.

along nape and anterior half of back the bristles form a distinct mane. The general color is blackish or dark brown, usually somewhat lightened by ochraceous or whitish tips and annulations, though sometimes almost uniform. A whitish streak extends backward from angle of mouth. Skull with rostral portion not specially elongated, the distance from middle of interorbital space to tip of nasals never conspicuously more than twice distance from same region to posterior median point of occiput. Interpterygoid fossa extending so far forward that it lies mostly between the posterior branches of the palatines. Narrowest region of parietals equal to about half interorbital space. Third lower molar with at least three median cusps, three paired transverse cusps, and a terminal heel representing a modified fourth group of paired cusps. Mandibular canine of male with outer face much shorter than inner and barely equal to the posterior face.

In the Malay region these pigs are strictly confined to the mainland and the near-by islands. In the Archipelago they are replaced by the members of the closely related *Sus vittatus* group. The species may be distinguished as follows:

KEY TO THE INDIAN AND MALAYAN FORMS OF THE *SUS CRISTATUS* GROUP.

- Ear large (about 135 by 130 mm.), conspicuously fringed with hairs 30 to 60 mm. long; upper length of skull about 430 mm.; third molar both above and below with terminal portion behind last complete transverse ridge highly complicated in structure, the number of enamel spaces indicated in  $m^2$  about 10, in  $m^3$  about 7 (see Plates LVIII, fig. 1, and LIX, figs. 1, 2) Indian.....*Sus cristatus*  
 Ear medium (about 105 by 100), inconspicuously fringed with hairs less than 20 mm. long; upper length of skull usually less than 400 mm.; third molar both above and below with terminal portion behind last complete transverse ridge simple in structure, the number of enamel spaces indicated in  $m^2$  4 to 6, in  $m^3$  usually 5 (see Plates LVIII, fig. 2, and LIX, fig. 3) Malayan.  
     Upper length of skull in adult male about 380 mm .....*Sus jubatus*, p. 745.  
     Upper length of skull in adult male about 330 mm .....*Sus jubatulus*, p. 746.

**SUS JUBATUS, new species.**

Plates LV, LVI, LVIII, and LIX.

*Type*.—Adult male (skin and skull), No. 83518, U.S.N.M. Collected in Trong, Lower Siam, by Dr. W. L. Abbott, in 1896.

*Geographic distribution*.—The range of this species, so far as definitely known, does not extend beyond the central portion of the Malay Peninsula.

*Characters*.—In general resembling *Sus cristatus*, but a distinctly smaller animal, the skull probably never exceeding 400 mm. in length, the ears relatively smaller and almost naked, never with a conspicuous fringe of hairs, and the enamel pattern of the posterior portion of last molar both above and below distinctly less complicated. (See Plates LVIII and LIX.) In *Sus cristatus* the terminal part of  $m^2$  behind the second transverse ridge contains from eight to twelve partly or wholly

isolated enamel spaces, while in *Sus jubatus* there are only from four to six. Similarly in the last lower molar of the Indian boar there are from six to nine small cusps (represented by enamel spaces in worn teeth) behind the third transverse ridge, while in the Malayan animal there are only from three to five. In general form the skulls of the two species do not differ appreciably; at least, no definite characters are shown by the specimens compared.

*Measurements.*—For measurements see table, pages 755 and 756.

*Specimens examined.*—Thirteen, from the following localities: Trong, Lower Siam, 2 (1 skin); Victoria Island, opposite Victoria Point, Tenasserim, 1; Boyces Point, Tenasserim, 3 (2 skins); Tanjong Badak, Tenasserim, 4; Champang, Tenasserim, 2; Bok Pyin, Tenasserim, 1.

*Remarks.*—The series of skins shows considerable variation in the amount of light tipping to the hairs. In the majority of cases a dull, uniform grizzle is produced; but some skins are nearly black, while in others the light brown strongly predominates. The mane is always well developed and the ear is never distinctly fringed. The light streak extending back from angle of mouth is invariably present, though in none of the skins is it as well developed as in some specimens of *Sus vittatus*.

#### SUS JUBATULUS, new species.

*Type.*—Adult male (skin and skull), No. 123918, U.S.N.M. Collected on Pulo Teratau (or Trotto), off west coast of Malay Peninsula, November 11, 1903, by Dr. W. L. Abbott. Original number, 2859.

*Geographic distribution.*—Pulo Teratau, and perhaps other islands off the west coast of the Malay Peninsula.

*Characters.*—Like *Sus jubatus*, but not as large; head and body of adult male about 1250 mm.; upper length of skull of adult male about 320 mm. Externally the animal closely resembles *Sus jubatus*, except for the difference in size. The skull of the type has the brain case relatively broader and shorter than in any of the specimens of *Sus jubatus*, but this may prove to be an individual character. Otherwise it shows no peculiarities worthy of note. Posterior molar both above and below (the only teeth in which the enamel pattern is not worn away), with cusps behind last transverse ridge more complicated than usual in *Sus jubatus*, but in no way approaching the conditions found in *Sus cristatus*.

*Measurements.*—For measurements, see table, pages 755 and 756.

*Specimens examined.*—One, the type.

*Remarks.*—Two specimens from Kisseraing Island, Mergui Archipelago (young female, No. 124206, February 3, 1904, and adult female, No. 124207, February 4, 1904), also represent a dwarf form of the

*cristatus* group, though whether it is the same as *Sus jubatus* I am unable to say. The principal measurements of the adult skull are as follows: Upper length, 302; basal length, 268; basilar length, 254; palatal length, 189; width of palate at pm <sup>1</sup>, 32; width of palate, including last molar, 61.6; least width of palate at front of last molar, 22.4; zygomatic breadth, 130; least interorbital breadth, 63.6; parietal constriction, 33; nasal breadth at posterior extremity of premaxillaries, 29.6; length of nasals, 144; occipital depth, 93.6; mandible, 228; maxillary toothrow, 112; m <sup>2</sup>, 20 by 18; m <sup>3</sup>, 32 by 19.6; mandibular toothrow, 106; m <sub>2</sub>, 20.4 by 15; m <sub>3</sub>, 35.6 by 16.6.

### III.—THE *SUS VITTATUS* GROUP.

Throughout that portion of the Malay Archipelago thus far explored by Doctor Abbott, the members of the *Sus vittatus* group are the most numerous of the wild pigs. They occur from the Natunas on the east to the Nicobars and Andamans on the west, but are not yet known from the Malay Peninsula, except at its southern extremity. Although not certainly distinguishable from *Sus jubatus* in general external features, at least so far as these are shown by the skins, the animals are immediately recognizable by the reduced condition of the posterior molar. In the upper jaw this tooth (Plate LVIII, fig. 3) contains two cross ridges and a very small terminal heel; while in the lower jaw (Plate LXIV, fig. 1) it may terminate abruptly at the third cross ridge, which is often reduced to a single median tubercle, or a minute supplemental tubercle may occur behind this ridge. The lower canine in males resembles that of *Sus cristatus* and *Sus jubatus*.

Among the forty-one specimens in the National Museum, I find the following species:

#### KEY TO THE MEMBERS OF THE *SUS VITTATUS* GROUP COLLECTED BY DOCTOR ABBOTT AND MR. KLOSS.

Upper length of skull in adult male less than 290 mm., in female less than 270 mm.

Length of upper toothrow about 83 mm. .... *Sus andamanensis*, p. 754

Length of upper toothrow about 95 mm.

Palate wide, distinctly exceeding width of m<sup>3</sup> posteriorly.

*Sus nicobaricus*, p. 754

Palate not very wide, scarcely or not exceeding width of m<sup>3</sup> posteriorly.

*Sus minus*, p. 753

Upper length of skull in adult male more than 290 mm., in female more than 270 mm.

Upper molars much enlarged, the greatest breadth of m<sup>3</sup> noticeably greater than width of palate at front of this tooth. .... *Sus niadensis*, p. 751

Upper molars not specially enlarged, the greatest breadth of m<sup>3</sup> usually much less than width of palate at front of this tooth.

Width of palate including third molars less than half length of toothrow to front of canine in males or to third incisor in females.

Width of parietal constriction equal to or greater than combined width of nasals at posterior extremity of premaxillaries. .... *Sus vittatus*, p. 748

Width of parietal constriction decidedly less than combined width of nasals at posterior extremity of premaxillaries. .... *Sus rhionis*, p. 749

Width of palate including third molars equal to or more than half length of toothrow to front of canine in males or to third incisor in females.

Upper length of skull about 340 mm. in males, 320 mm. in females.

*Sus peninsularis*, p. 749

Upper length of skull about 310 mm. in males, 285 mm. in females.

An obvious though short diastema between canine and first premolar ..... *Sus babi*, p. 752

No evident diastema between canine and first premolar.

*Sus natunensis*, p. 753

### SUS VITTATUS Müller and Schlegel.

Plates LVIII and LXIV.

1839-44. *Sus vittatus* MÜLLER and SCHLEGEL, *Verhandel. over de Natuurlijke Geschiedenis der Nederl. overzeesche Bezittingen, Zoologie*, p. 172, pls. xxix, xxxii. (Part.)

1905. *Sus vittatus* JENTINK, *Notes from the Leyden Museum*, XXVI, p. 175, October 16, 1905 (name restricted to Sumatran animal).

*Type locality*.—Sumatra.

*Geographic distribution*.—Mainland of Sumatra.

*Characters*.—Size about the maximum for the group, head and body of adult female about 1250 mm. (male not examined), upper length of skull 300 mm. or more; skull slender, the width of palate including widest part of posterior molars slightly more than half distance from back of last molar to front of canine in female; a distinct diastema between canine and first premolar; braincase not specially narrowed posteriorly, the parietal constriction equal to or wider than nasals; teeth of moderate size, the last two upper molars together about 45 mm. long; greatest breadth of last molar distinctly less than least width of palate at front of this tooth.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Four collected by Doctor Abbott—one on the Indragiri River, eastern Sumatra, three at Tarussan Bay, western Sumatra; also the Sumatran material in Leyden described by Doctor Jentink,<sup>a</sup> and that in Berne recorded by Doctor Volz.<sup>b</sup>

*Remarks*.—As Doctor Jentink has already pointed out, the pigs of this group from Java and Sumatra are specifically distinct. In the original description and figures of *Sus vittatus* the two animals are inextricably confused. The name has, however, been arbitrarily restricted to the Sumatran form.

A young female (No. 113034, August 25, 1901) from Linga Island may represent either this species or the next.

<sup>a</sup> Notes from the Leyden Museum, XXVI, pp. 174-176, October, 1905.

<sup>b</sup> Zool. Jahrb., Abth. Syst., XX, pp. 513-518, July 16, 1904.

**SUS RHIONIS, new species.**

Plates LX, LXI, and LXIV.

*Type*.—Young adult male (skin and skull), No. 122928, U.S.N.M. Collected on Pulo Ungar, Rhio Archipelago, June 26, 1903, by Dr. W. L. Abbott. Original number, 2555.

*Characters*.—Like *Sus vittatus*, but with distinctly narrower skull, the constriction of the parietals so great that the least width of braincase on upper surface is in adults always noticeably less than width of both nasals together at posterior extremity of primaxillaries (Plate LX, fig. 2; plate LXI, fig. 2). Teeth as in *Sus vittatus*.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Twelve, from the following islands in the Rhio Archipelago: Pulo Ungar, 9 (6 skins); Pulo Sugi Bawa, 2 (1 skin); Great Karimon, 1.

*Remarks*.—The pigs from the Rhio Archipelago show an exaggeration of the slenderness of skull that characterizes *Sus vittatus*. This is accompanied by a very marked narrowing of the parietal constriction. In two skulls of adult female *Sus vittatus* (Nos. 113151 and 141028, U.S.N.M.) the least width of this constriction is, respectively, 30 mm. and 33 mm., while the nasal breadth at posterior extremity of premaxillary is 30 mm. and 28 mm. In the four males recorded by Doctor Volz<sup>a</sup> it is 34 mm., 34.5 mm., 34 mm., and 31 mm., as compared with nasal breadths of 31 mm., 29 mm., 34 mm., and 30.5 mm. Therefore in six adult skulls the parietal constriction invariably equals or exceeds the nasal breadth, the averages for the two measurements being 32.7 mm. and 30.4 mm. A like number of adult skulls of *Sus rhionis* give the following measurements: Four females, parietal constriction, 22 mm., 16.4 mm., 13 mm., and 12.8 mm.; nasal breadth, 26 mm., 26 mm., 25 mm., and 22.6 mm.; two males, parietal constriction, 17 mm. and 22.6 mm.; nasal breadth, 27 mm. and 30.6 mm. The parietal constriction in these specimens is invariably narrower than the nasals; averages of the two measurements, 17.3 and 26.3. The average basal length for the two lots of skulls is: *vittatus*, 280 mm.; *rhionis*, 276 mm. In five immature specimens of *Sus rhionis*, the parietal constriction is with only one exception less than the nasal breadth; in this skull (female No. 122929) the two measurements are the same.

Externally the animal resembles *Sus vittatus*, and the skins show no variations worthy of note.

**SUS PENINSULARIS, new species.**

Plate LVII.

*Type*.—Adult female (skull only), No. 142470, U.S.N.M. Collected near foot of Gunong Pulai, southwestern Johore, by C. B. Kloss.

<sup>a</sup>Zool. Jahrb., Abth. Syst., XX, p. 517, July 16, 1904.

*Geographic distribution.*—Southern extremity of the Malay Peninsula.

*Characters.*—Largest known member of the *Sus vittatus* group; upper length of skull in adult male about 340 mm.; in adult female about 320 mm. Skull essentially like that of *Sus vittatus* in form. Teeth similar to those of *Sus vittatus*, but much larger, particularly the last two molars both above and below (see table of measurements, pages 755 and 756). Owing to the large size of the skull, however, the teeth do not encroach on the palate, as is the case in *Sus niadensis*.

*Measurements.*—For measurements see table, pages 755 and 756.

*Specimens examined.*—Four, all from Johore. The exact localities are as follows: Gunong Pulai (the type), Johore Bahru (skin and skull of immature male, No. 125462, collected May 5, 1904), and Mount Austin (skin and skull of immature male, No. 125463, collected May 23, 1904). Mr. Kloss has also presented the skull of a young adult male (No. 142469), of which the exact locality is not known.

*Remarks.*—This animal is so large that on first seeing the skulls of the two adults I mistook it for a member of the *Sus cristatus* group. It is, however, readily distinguishable from *Sus jubatulus*, which it resembles in size, by the simpler structure of the molars. In its robust form the skull of this pig differs notably from that of *Sus rhionis*, its nearest ally geographically. As to external characters the two skins furnish no satisfactory basis for comparison with other forms, as both are in scant, much-worn pelage. On posterior half of back there is a noticeable sprinkling of reddish bristles, a character which I have never seen in *Sus jubatus* or *Sus jubatulus*, but which occurs not infrequently in members of the *vittatus* group.

In cranial characters the two adults and one of the young (that from Mount Austin) show no variations except those readily explained as due to differences in sex and age.

The Johore Bahru skull, however (Plate LVII, fig. 1), differs remarkably from these, as well as from all the other specimens of the group or of the *cristatus* group that I have examined, in the peculiar shape of the palatine and pterygoid bones. In the normal form the backward prolongations of the palatines which bound the "interpterygoid"<sup>a</sup> space diverge strongly and at the same time rise noticeably above level of palate (skull held upside down), so that if continued backward they would extend lateral to and above tips of styloid processes; outer plate of pterygoid sufficiently expanded to form between it and the rather short, broad, hamular process a deep pterygoid fossa; greatest palatal width, including outer pterygoid plate, considerably more than half distance from posterior median edge of palate to foramen magnum. In No. 125462 the palatine bones diverge so slightly and rise so little above level of palate that they would, if extended, touch the

<sup>a</sup>The space here lies chiefly between the palatines.

extremities of styloid processes; outer plate of pterygoid so little expanded that the pterygoid fossa is scarcely more than a flattened depression, from the inner side of which projects the long, slender, hamular process; greatest palatal width, including outer pterygoid plate, much less than half distance from posterior median edge of palate to foramen magnum. That this peculiar structure is not due to immaturity is shown by the perfect constancy of the broadly divergent type at all ages, from suckling young to the oldest adults. It clearly represents a very unusual individual variation or a distinct species. I find it impossible, however, to reach any satisfactory conclusion from the material at hand.

**SUS NIADENSIS, new species.**

Plates LXII, LXIII, and LXIV.

*Type*.—Adult female (skin and skull) No. 141167, U.S.N.M. Collected on Nias Island, March 30, 1905, by Dr. W. L. Abbott. Original number, 4155.

*Characters*.—Similar to *Sus vittatus*, but with posterior molars considerably enlarged, the combined length of the last two teeth more than 50 mm., the greatest width of posterior upper molar noticeably more than least width of palate at front of this tooth. (Plate LXII fig. 1.) No evident diastema between canine and first premolar in female (male not known). Color normal.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Four (3 skins), all from Nias Island.

*Remarks*.—The Nias pig differs from all the other known members of the *vittatus* group in the conspicuous enlargement of the posterior two molars both above and below.

The differences in size of these teeth between this animal and *Sus vittatus* and *Sus rhionis* are as follows:

|                            | Number. | Sex.          | M <sup>1</sup> . | M <sup>2</sup> . | M <sup>3</sup> . | M <sup>4</sup> . |
|----------------------------|---------|---------------|------------------|------------------|------------------|------------------|
| <i>Sus niadensis</i> ..... | 141166  | Female .....  | 21.8 by 19.6     | 31.4 by 21.0     | 20.4 by 15.4     | 33.0 by 17.4     |
| Do .....                   | 141167  | .....do ..... | 22.0 by 20.0     | 34.0 by 24.0     | 21.4 by 15.8     | 37.6 by 19.0     |
| Do .....                   | 141168  | .....do ..... | 22.4 by 20.0     | 33.0 by 22.4     | 21.4 by 16.2     | 38.0 by 19.6     |
| <i>Sus vittatus</i> .....  | 113151  | .....do ..... | 18.0 by 16.0     | 26.0 by 16.4     | 17.0 by 14.0     | 29.0 by 16.0     |
| Do .....                   | 141028  | .....do ..... | 19.0 by 17.0     | 27.0 by 20.0     | 18.8 by 14.0     | 32.8 by 16.6     |
| Do .....                   | 141029  | .....do ..... | 19.8 by 17.0     | 30.0 by 19.0     | 19.8 by 14.8     | 29.0 by 15.8     |
| <i>Sus rhionis</i> .....   | 115682  | .....do ..... | 15.6 by 15.0     | 25.0 by 18.0     | .....            | 26.4 by 15.6     |
| Do .....                   | 122924  | .....do ..... | 19.2 by 16.0     | 26.0 by 18.0     | 18.8 by 13.4     | 27.0 by 16.0     |
| Do .....                   | 122925  | .....do ..... | 18.0 by 15.8     | 24.6 by 17.8     | 18.0 by 13.0     | 26.4 by 15.4     |

In size and form the skull closely agrees with that of *Sus vittatus*, showing no tendency toward the broadening characteristic of the species occurring on the islands north of Nias. In fact, so far as can be determined from the material examined, the zygomata appear to be less abruptly flaring than in the mainland pig.

**SUS BABI, new species.**

Plates LX and LXI.

*Type*.—Adult male (skin and skull), No. 114283, U.S.N.M. Collected on Pulo Babi,<sup>a</sup> west Sumatra, January 14, 1902, by Dr. W. L. Abbott. Original number, 1413.

*Geographic distribution*.—Pulo Babi and Pulo Tuangku, west Sumatra.

*Characters*.—About the size of *Sus vittatus*, but skull noticeably broader in proportion to its length, the width of palate including last molars distinctly greater than half distance from back of third molar to front of canine in males or to third incisor in females. (Plate LX fig. 1, plate LXI, fig. 1.) Combined length of last two upper molars about 47 mm.; greatest breadth of m<sup>3</sup> noticeably less than least width of palate at front of this tooth. A distinct though short diastema between canine and first premolar. Color very dark.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Five, three (2 skins) from Pulo Babi and two from Pulo Tuangku.

*Remarks*.—In the two skins from Pulo Babi the hair is very dark, giving the animal a uniform blackish appearance throughout, except where the yellowish skin shows through at the surface. In the type the bristles of the mane and forehead are rather noticeably lightened by wood-brown annulations, and similar though shorter rings produce an evident light band across muzzle about halfway between eye and snout; throat with a few scattered light tips and annulations, but these not numerous enough to form stripes behind angles of mouth. In the other skin (female, No. 114282) even this slight degree of light marking is absent, and the entire animal is practically black. One of the skins from Pulo Tuangku (female, No. 114415) is nearly as dark as the type, but the other (male, No. 114416) is of the usual grizzled style of coloration. The skulls from the two islands show no variations worthy of note. Two females from Engano—one (No. 140959) very old, the other (No. 140958) immature—resemble *Sus babi*, though I do not feel convinced that they should be considered the same. Upper length of skull of adult, 298; parietal constriction, 29; nasal breadth, 33; last upper molar, 27.6 by 17.6. In both specimens the audital bullæ are somewhat enlarged.

<sup>a</sup> This island lies about halfway between Simalur and the outermost of the Banjak group, Pulo Bangkaru. It is a small island not shown on ordinary maps, and must be carefully distinguished from Simalur, often called Pulo Babi ("Pig Island").

**SUS NATUNENSIS** Miller.

1901. *Sus natunensis* MILLER, Proc. Washington Acad. Sci., III, p. 117, March 26, 1901.

*Type locality*.—Pulo Laut, North Natuna Islands.

*Geographic distribution*.—The North Natuna Islands.

*Characters*.—Closely resembling *Sus babi*, but with rostral portion of skull more shortened and broadened; width of palate, including last molars, about half as great as distance from back of third molar to front of third incisor in female (male not known); no diastema between canine and first premolar; color not unusually dark.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Three, the type and a young female (No. 104857, skull only) from Pulo Laut, and an adult female (No. 105855) from Pulo Lingung.

*Remarks*.—The Natuna pig is readily distinguishable from *Sus vittatus* by its shorter, broader skull (upper length in adult females about 20 mm. less than in the Sumatran animal, but zygomatic breadth fully as great or slightly more, and combined breadth of nasals decidedly greater). It more closely resembles the geographically distant *Sus babi*, but differs in its broader, more elevated brain case; parietal constriction somewhat wider than nasals, instead of decidedly narrower, as in *Sus babi*. The toothrow is more crowded than in *Sus babi*, as shown by the anterior premolars of the upper jaw.

**SUS MIMUS**, new species.

*Type*.—Adult male (skin and skull), No. 114178, U.S.N.M. Collected on Simalur Island,<sup>a</sup> West Sumatra, November 25, 1901, by Dr. W. L. Abbott. Original number, 1353.

*Geographic distribution*.—Simalur Island.

*Characters*.—Like *Sus babi*, but much smaller; upper length of skull about 280 mm. in males, 265 mm. in females. Greatest width of third upper molar about equal to least width of palate at front of this tooth. A short but evident diastema between canine and first premolar in female, but not in male. Color, very dark, as in *Sus babi*.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Five, all from Simalur Island.

*Remarks*.—This appears to be a well-characterized dwarf species related to the larger animal of Pulo Babi and the Banjak Islands, and with a similarly broadened skull. It also shares the uniform blackish coloration of the related form.

<sup>a</sup>This is the northernmost of the large islands off the west coast of Sumatra. It is sometimes known as the Pulo Babi (see under *Sus babi*, p. 752).

**SUS NICOBARICUS** Miller.

1902. *Sus nicobaricus* MILLER, Proc. U. S. Nat. Mus., XXIV, p. 755, May 29, 1902.

*Type locality*.—Great Nicobar Island.

*Geographic distribution*.—This species is known from the type locality only, though it probably occurs on other islands of the Nicobar group.

*Characters*.—Very similar to *Sus mimus*, but rostral portion of skull heavier, palate wider, occiput higher, and angle in facial profile at base of nasals much more pronounced. Color, clear black throughout, except for a slight wash of brown on the mane. Hind feet of type specimen white, but probably abnormal in color.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Two, the type, and an adult male (skull only) from the type locality.

*Remarks*.—The pig of the Nicobars is closely allied to that of Simalur, though the material examined indicates that the animals are specifically distinct. This relationship finds an exact parallel in that of the monkeys, *Macaca umbrosa* and *M. fusca*, inhabiting the same islands.<sup>a</sup>

**SUS ANDAMANENSIS** Blyth.

Plate LXII.

1858. *Sus andamanensis* BLYTH, Journ. Asiat. Soc. Bengal, XXVII, p. 267.

*Type locality*.—Port Blair, South Andaman Island.

*Geographic distribution*.—Andaman Islands.

*Characters*.—Smaller than *Sus mimus* and *Sus nicobaricus*; skull (Plate LXII, fig. 2) slender, essentially a miniature of that of *Sus vittatus*; a very slight angle in facial profile at base of nasals; upper toothrow only about 83 mm. in length. The one skin seen is black, with a distinct brownish wash on mane. The ears, cheeks, muzzle, and throat are very scantily haired.

*Measurements*.—For measurements see table, pages 755 and 756.

*Specimens examined*.—Two, an adult male (skin and skull, No. 111816) from Little Andaman Island, and a nearly adult female with no definite locality (No. 164755, Department of Anthropology, a skull ornamented with red paint by the native Andamanese).

*Remarks*.—The Andaman pig, though strictly a member of the *Sus vittatus* group,<sup>b</sup> is even more dwarfed than the small *Sus mimus* and *Sus nicobaricus*. Notwithstanding its conspicuously smaller size, *Sus andamanensis* rather closely resembles *Sus vittatus* of the Sumatran mainland in the form of its skull, thus differing notably from its nearest insular allies.

<sup>a</sup> See Miller, Proc. U. S. Nat. Mus., XXIV, p. 789, May 28, 1902, and XXVI, p. 476, February 3, 1903.

<sup>b</sup> Comparisons of *Sus andamanensis* with *Sus cristatus* (e. g. Miller, Proc. U. S. Nat. Mus., XXIV, pp. 754-757, May 28, 1902) are therefore very misleading.

Table of cranial measurements of *Malayan pigs*.

| Name.                         | Locality.                       | Number. | Sex.   | Upper length. | Basal length. | Basilar length. | Palatal length. | Width of palate at pm. | Width of palate including m. | Least width of palate at front of m. | Zygomatic breadth. | Least interorbital breadth. | Parietal constriction. | Nasal breadth at posterior extremity of pmx. | Length of nasals. |
|-------------------------------|---------------------------------|---------|--------|---------------|---------------|-----------------|-----------------|------------------------|------------------------------|--------------------------------------|--------------------|-----------------------------|------------------------|--|-------------------|
| <i>Sus barbatus</i> .....     | Borneo; Banjarmassing           | (a)     | Female | 430           | 375           |                 | 295             | 49.0                   |                              |                                      | 136.0              |                             |                        | 36.0   | 217.0             |
| Do.....                       | do                              |         | Male   | 440           | 395           |                 | 310             | 47.0                   |                              |                                      | 154.0              |                             |                        | 31.0   | 223.0             |
| Do.....                       | Borneo; southeastern            | (b)     | do     | 450           | 400           |                 | 320             | 48.0                   |                              |                                      | 166.0              |                             |                        | 31.0   |                   |
| Do.....                       | Borneo; Sandakan                | 34691   | do     | 465           | 397           | 576             |                 | 45.0                   | 71.0                         | 25.0                                 | 148.0              |                             | 16.0                   | 38.0   | 230.0             |
| <i>Sus cf.</i> .....          | Sumatra; Indragiri River        | a113150 | do     | 480           | 410           | 390             |                 | 50.0                   | 72.6                         | 28.4                                 | 162.0              |                             | 11.0                   | 38.0   | 240.0             |
| <i>Sus cf. barbatus</i> ..... | Borneo; southern                | (c)     | do     | 570           | 455           |                 | 330             | 50.0                   |                              |                                      | 185.0              |                             |                        | 43.0   | 278.0             |
| <i>Sus barbatus</i> .....     | India; Nilgiri Hills            |         | do     |               |               |                 | 367             | 50.0                   |                              |                                      |                    |                             |                        | 41.0   |                   |
| <i>Sus barbatus</i> .....     | Tenasserim; Trong               | a12536  | do     | 430           | 320           | 805             |                 | 50.0                   | 77.8                         | 32.0                                 | 172.4              |                             | 38.8                   | 35.0   | 182.0             |
| Do.....                       | Lower Siam; Bangkok             | a13518  | do     | 380           | 320           | 805             |                 | 50.0                   | 74.6                         | 27.6                                 | 154.0              |                             | 38.6                   | 35.4   | 175.4             |
| <i>Sus barbatus</i> .....     | Sumatra; Palembang              | 111982  | Female | 364           | 316           | 298             |                 | 42.0                   | 72.0                         | 29.0                                 | 140.0              |                             | 35.6                   | 32.0   | 160.4             |
| <i>Sus vittatus</i> .....     | Sumatra; Indragiri River        | a123918 | Male   | 318           | 278           | 266             |                 | 37.4                   | 65.0                         | 26.0                                 | 140.0              |                             | 44.0                   | 32.0   | 143.6             |
| Do.....                       | Rho Archipelago; Pulo Ungar     | (d)     | do     | 328           | 284           | 268             |                 | 37.4                   |                              | 25.0                                 | 137.0              |                             | 31.0                   | 30.5   | 142.0             |
| <i>Sus thionis</i> .....      | do                              | 113151  | Female | 305           | 267           | 258             |                 | 35.0                   | 60.0                         | 25.0                                 | 126.0              |                             | 30.0                   | 30.0   | 136.0             |
| Do.....                       | do                              | a122928 | Female | 330           | 290           | 275             |                 | 32.6                   | 60.0                         | 22.0                                 | 132.0              |                             | 37.0                   | 37.0   | 159.0             |
| <i>Sus peninularis</i> .....  | do                              | 123924  | Female | 365           | 262           | 248             |                 | 26.4                   | 58.0                         | 21.0                                 | 118.0              |                             | 27.0                   | 26.0   | 140.0             |
| Do.....                       | do                              | a142470 | Male   | 340           | 302           | 292             |                 | 40.0                   | 66.6                         | 25.6                                 | 133.0              |                             | 44.0                   | 32.6   | 160.0             |
| <i>Sus babi</i> .....         | Sumatra; Pulo Babi              | a114178 | Female | 318           | 276           | 260             |                 | 38.0                   | 70.0                         | 29.0                                 | 131.6              |                             | 30.0                   | 30.0   | 151.0             |
| Do.....                       | Sumatra; Pulo Tuan              | 288     | Female | 305           | 278           | 260             |                 | 43.0                   | 68.0                         | 27.0                                 | 136.0              |                             | 28.0                   | 31.6   | 151.0             |
| <i>Sus natunensis</i> .....   | Natuna Islands; Pulo Lant       | a104856 | Female | 288           | 263           | 250             |                 | 35.0                   | 66.6                         | 26.0                                 | 128.0              |                             | 28.0                   | 28.0   | 135.0             |
| <i>Sus natunensis</i> .....   | do                              | a114178 | Male   | 282           | 260           | 235             |                 | 32.2                   | 66.0                         | 24.0                                 | 130.0              |                             | 31.4                   | 30.4   | 135.0             |
| Do.....                       | Sumatra; Simalur Island         | a114178 | Female | 280           | 258           | 240             |                 | 31.4                   | 61.0                         | 22.4                                 | 121.0              |                             | 18.0                   | 26.0   | 117.0             |
| Do.....                       | Sumatra; Nias Island            | a141167 | do     | 313           | 278           | 260             |                 | 31.4                   | 68.0                         | 19.4                                 | 119.0              |                             | 28.0                   | 28.0   | 143.0             |
| <i>Sus nicobarensis</i> ..... | Nicobar Islands; Great Nicobar  | 112011  | Male   | 280           | 260           | 225             |                 | 42.0                   | 65.0                         | 28.0                                 | 130.0              |                             | 26.0                   | 30.0   | 133.0             |
| <i>Sus andamanensis</i> ..... | Andaman Islands; Little Andaman | 111816  | do     | 280           | 252           | 235             |                 | 42.0                   | 57.4                         | 21.6                                 | 114.0              |                             | 18.0                   | 21.6   | 123.0             |
| Do.....                       | Andaman Islands                 | 164765  | Female | 256           | 224           | 213             |                 | 27.0                   | 50.4                         | 21.4                                 | 107.0              |                             | 37.0                   | 22.0   |                   |

a Type.

b Type of *Sus longirostris* Nehring.

c Condyllobasal length, 370.

d From Vozz, specimen No. 4.

Table of cranial measurements of Malayen pigs—Continued.

| Name.                         | Locality.                       | Number.  | Sex.    | Occipital depth to basion. | Mandible. | Maxillary tooth row (alveoli). | Second upper molar. | Third upper molar. | Mandibular tooth row (alveoli). | Second lower molar. | Third lower molar. |
|-------------------------------|---------------------------------|----------|---------|----------------------------|-----------|--------------------------------|---------------------|--------------------|---------------------------------|---------------------|--------------------|
| <i>Sus barbatus</i> .....     | Borneo; Banjarmasin             | (a)      | Female. | 119.0                      | 320       | 127.0                          | .....               | 83.0 by 19.6       | 6120.0                          | by 15.0             | .....              |
| Do.....                       | do.....                         | .....    | Male    | 130.0                      | 350       | 127.0                          | .....               | 87.0 by 23.5       | 6129.0                          | by 16.0             | .....              |
| Do.....                       | Borneo; southeastern            | (c)      | do      | 150.0                      | 350       | 182.0                          | .....               | 37.0 by 23.5       | 6137.0                          | by 16.0             | 47.0 by 21.0       |
| Do.....                       | Borneo; Sandakan                | 34891    | do      | 140.0                      | 350       | 186.4                          | 24.0 by 21.0        | 37.0 by 24.0       | 6134.0                          | 24.0 by 17.4        | 46.0 by 20.0       |
| Do.....                       | Sumatra; Indragiri River        | a 113150 | do      | 140.0                      | 360       | 129.4                          | 23.0 by 19.4        | 31.0 by 21.0       | 6122.0                          | 22.0 by 16.0        | 38.8 by 18.4       |
| <i>Sus gargarantua</i> .....  | Borneo; southeastern            | (a)      | do      | 167.0                      | 385       | 137.0                          | .....               | 37.0 by 23.0       | 6140.0                          | by 17.0             | 47.0 by 21.0       |
| <i>Sus cristatus</i> .....    | India; Nilgiri Hills.           | 122536   | do      | 140.0                      | 338       | 133.0                          | 22.6 by 22.0        | 45.0 by 22.6       | 6129.6                          | 23.0 by 17.0        | 49.0 by 19.0       |
| <i>Sus jubatus</i> .....      | Lower Siam; Trong               | a 83518  | do      | 129.0                      | 295       | 116.0                          | 21.0 by 19.8        | 34.0 by 22.0       | 6109.6                          | 19.8 by 16.0        | 40.0 by 19.0       |
| Do.....                       | Tenasserim; Tanjong Badak       | 111982   | Female. | 114.0                      | 274       | 122.0                          | 23.0 by 19.6        | 35.0 by 21.0       | 6117.0                          | 21.4 by 15.8        | 38.0 by 18.0       |
| <i>Sus jubatus</i> .....      | Pulo Teratan                    | a 123918 | Male    | 101.0                      | 251       | 106.0                          | 18.0 by 17.6        | 38.6 by 18.0       | 6103.0                          | 17.0 by 14.6        | 34.0 by 15.0       |
| <i>Sus vittatus</i> .....     | Sumatra; Palembang              | (a)      | do      | 108.0                      | 251       | .....                          | .....               | 30.5 by 16.4       | 591.4                           | 17.0 by 14.0        | 30.0 by 15.0       |
| Do.....                       | Sumatra; Indragiri River        | 113151   | Female. | 93.0                       | 233       | 97.0                           | 18.0 by 16.0        | 26.0 by 17.0       | 596.0                           | 18.0 by 13.0        | 29.0 by 16.0       |
| <i>Sus rhionis</i> .....      | Rho Archipelago; Pulo Ungar     | a 122928 | Male    | 97.4                       | 255       | 101.0                          | 19.2 by 16.0        | 26.0 by 18.0       | 596.0                           | 18.8 by 13.4        | 27.0 by 16.0       |
| Do.....                       | do.....                         | 122924   | Female. | 84.4                       | 232       | 99.0                           | 20.4 by 18.0        | 29.6 by 21.0       | 6106.6                          | 19.4 by 15.0        | 35.0 by 18.0       |
| <i>Sus peninsularis</i> ..... | Johore.                         | 142469   | Male    | 113.0                      | 270       | 112.4                          | 19.4 by 19.0        | 31.0 by 21.0       | 599.0                           | 19.0 by 15.4        | 34.6 by 17.0       |
| Do.....                       | Johore; Gunung Pulai.           | a 142170 | Male    | 105.0                      | 244       | 107.0                          | 20.0 by 17.8        | 30.0 by 19.0       | 596.0                           | 18.0 by 13.6        | 28.8 by 16.0       |
| <i>Sus babi</i> .....         | Sumatra; Pulo Babi              | 114293   | Female. | 106.0                      | 243       | 105.0                          | 18.6 by 17.4        | 27.0 by 18.8       | 597.0                           | 17.8 by 13.6        | 30.4 by 15.4       |
| Do.....                       | Sumatra; Pulo Tuangku           | 114415   | do      | 89.0                       | 225       | 102.0                          | 18.0 by 18.0        | 30.0 by 20.0       | 598.0                           | 18.0 by 13.6        | 30.0 by 16.0       |
| <i>Sus natunensis</i> .....   | Natuna Islands; Pulo Laut       | a 104856 | do      | 97.4                       | 218       | 105.0                          | 20.0 by 16.6        | 27.0 by 20.0       | 598.0                           | 18.0 by 13.6        | 30.0 by 16.0       |
| <i>Sus nimbus</i> .....       | Sumatra; Simalur Island         | a 114178 | Male    | 95.4                       | 213       | 98.0                           | 20.0 by 16.6        | 26.0 by 19.2       | 592.6                           | 18.0 by 13.0        | 29.0 by 15.0       |
| Do.....                       | do.....                         | .....    | Female. | 85.0                       | 203       | 95.6                           | 18.0 by 16.6        | 26.4 by 19.0       | 6112.6                          | 21.4 by 15.8        | 30.0 by 16.0       |
| <i>Sus niadensis</i> .....    | Sumatra; Nias Island            | a 141167 | do      | 92.0                       | 245       | 117.0                          | 22.0 by 20.0        | 34.0 by 24.0       | 6095.0                          | 16.0 by 14.0        | 27.0 by 13.6       |
| <i>Sus nicobaricus</i> .....  | Nicobar Islands; Great Nicobar  | 112011   | Male    | 103.0                      | 220       | 96.0                           | 17.0 by 17.0        | 26.0 by 18.0       | 6088.0                          | 16.0 by 14.0        | 27.0 by 13.6       |
| <i>Sus andamanensis</i> ..... | Andaman Islands; Little Andaman | 111816   | do      | 90.0                       | 200       | 83.0                           | 17.4 by 12.8        | 20.0 by 14.0       | .....                           | .....               | .....              |
| Do.....                       | Andaman Islands                 | 164765   | Female. | .....                      | 180       | 83.0                           | .....               | .....              | .....                           | .....               | .....              |

<sup>a</sup>Type.      <sup>b</sup>Anterior premolar not included.      <sup>c</sup>Type of *Sus longirostris* Nehring.      <sup>d</sup>From Volz, specimen No. 4.

## EXPLANATION OF PLATES.

[Unless otherwise stated the figures are about one-third natural size.]

## PLATE XXXIX.

*Sus barbatus* Müller. Adult male, Cat. No. 34891, U.S.N.M. Sandakan, Borneo.

## PLATE XL.

*Sus oi* Miller. Type.

## PLATE XLI.

*Sus gargantua* Miller. Type.

## PLATE XLII.

*Sus barbatus* Müller. Adult male, Cat. No. 34891, U.S.N.M. Sandakan, Borneo.

## PLATE XLIII.

*Sus oi* Miller. Type.

## PLATE XLIV.

*Sus gargantua* Miller. Type.

## PLATE XLV.

*Sus barbatus* Müller. Adult male, Cat. No. 34891, U.S.N.M. Sandakan, Borneo.

## PLATE XLVI.

*Sus oi* Miller. Type.

## PLATE XLVII.

*Sus gargantua* Miller. Type.

## PLATE XLVIII.

1. *Sus barbatus* Müller. Adult male, Cat. No. 34891, U.S.N.M. Sandakan, Borneo.2. *Sus gargantua* Miller. Type.

## PLATE XLIX.

1. *Sus barbatus* Müller. Adult male, Cat. No. 34891, U.S.N.M. Sandakan, Borneo.  
Mandibular cheek teeth, slightly reduced.2. *Sus gargantua* Miller. Type. Mandibular cheek teeth, slightly reduced.3. *Sus oi* Miller. Type. Mandibular cheek teeth, slightly reduced.

## PLATE L.

*Sus gargantua* Miller. Type. Maxillary cheek teeth, slightly reduced.

## PLATE LI.

*Sus barbatus* Müller. Adult male, Cat. No. 34891, U.S.N.M. Sandakan, Borneo.  
Greatly reduced.

## PLATE LII.

*Sus oi* Miller. Type. Greatly reduced.

## PLATE LIII.

*Sus cristatus* Wagner. Adult male, Cat. No. 122536, U.S.N.M. Nilgiri Hills, India.

## PLATE LIV.

*Sus cristatus* Wagner. Adult male, Cat. No. 122536, U.S.N.M. Nilgiri Hills, India.

## PLATE LV.

*Sus jubatus* Miller. Type.

## PLATE LVI.

*Sus jubatus* Miller. Type.

## PLATE LVII.

1. *Sus peninsularis*? Young male, Cat. No. 125462, U.S.N.M. Johore Bahru, Johore.
2. *Sus peninsularis* Young male, Cat. No. 125463, U.S.N.M. Mount Austin, Johore.

## PLATE LVIII.

1. *Sus cristatus* Wagner. Adult male, Cat. No. 122536, U.S.N.M. Nilgiri Hills, India. (About  $\frac{2}{3}$  nat. size.) Maxillary teeth.
2. *Sus jubatus* Miller. Type. (About  $\frac{2}{3}$  nat. size.) Maxillary teeth.
3. *Sus vittatus* Müller and Schlegel. Adult female, Cat. No. 141028, U.S.N.M. Tarussan Bay, west Sumatra. (About  $\frac{2}{3}$  nat. size.) Maxillary teeth.

## PLATE LIX.

1. *Sus cristatus* Wagner. Adult male, Cat. No. 122536, U.S.N.M. Nilgiri Hills, India. (About  $\frac{2}{3}$  nat. size.) Mandibular teeth.
2. *Sus cristatus* Wagner, or closely related form, Cat. No. 61310, U.S.N.M. Ceylon. (About  $\frac{2}{3}$  nat. size.) Mandibular teeth.
3. *Sus jubatus* Miller. Type. (About  $\frac{2}{3}$  nat. size.) Mandibular teeth.

## PLATE LX.

1. *Sus babi* Miller. Type.
2. *Sus rhionis* Miller. Type.

## PLATE LXI.

1. *Sus babi* Miller. Type.
2. *Sus rhionis* Miller. Type.

## PLATE LXII.

1. *Sus niadensis* Miller. Type.
2. *Sus andamanensis* Blyth. Adult male, Cat. No. 111816, U.S.N.M. Little Andaman Island.

## PLATE LXIII.

1. *Sus niadensis* Miller. Young female, Cat. No. 141169, U.S.N.M. Nias Island, west Sumatra.
2. *Sus oi* Miller. Young male, Cat. No. 122930, U.S.N.M. Pulo Kundur, Rhio Archipelago.

## PLATE LXIV.

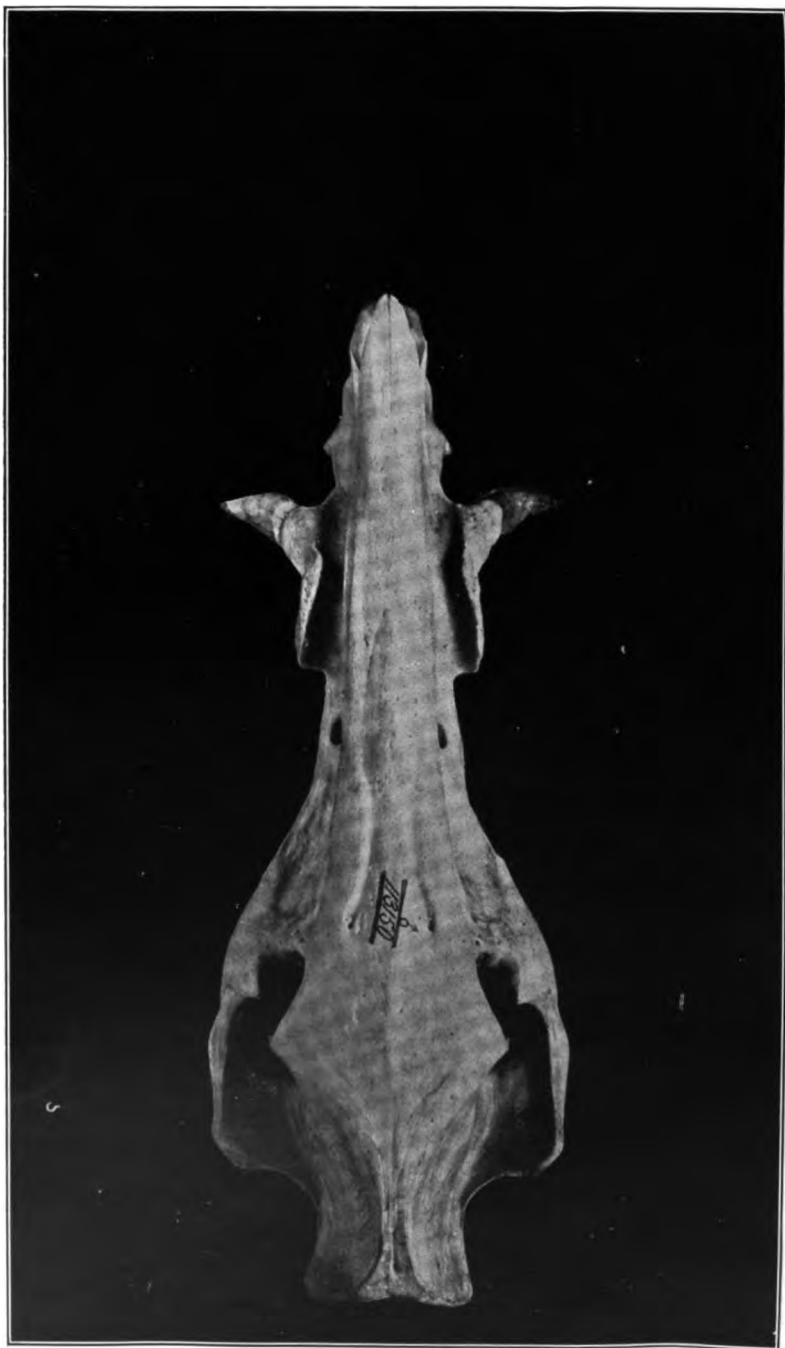
1. *Sus vittatus* Müller and Schlegel. Adult female, Cat. No. 141028, U.S.N.M. Tarussan Bay, west Sumatra. (About  $\frac{2}{3}$  nat. size.) Mandibular teeth.
2. *Sus niadensis* Miller. Type. (About  $\frac{2}{3}$  nat. size.) Mandibular teeth.
3. *Sus rhionis* Miller. Type. (About  $\frac{2}{3}$  nat. size.) Mandibular teeth.



**SUS BARBATUS.**

FOR EXPLANATION OF PLATE SEE PAGE 757.





SUS OI. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 757.





**SUS BARBATUS.**

FOR EXPLANATION OF PLATE SEE PAGE 757.





SUS OI. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 757.





**SUS GARGANTUA. TYPE.**

FOR EXPLANATION OF PLATE SEE PAGE 757.





*SUS BARBATUS.*

FOR EXPLANATION OF PLATE SEE PAGE 757.

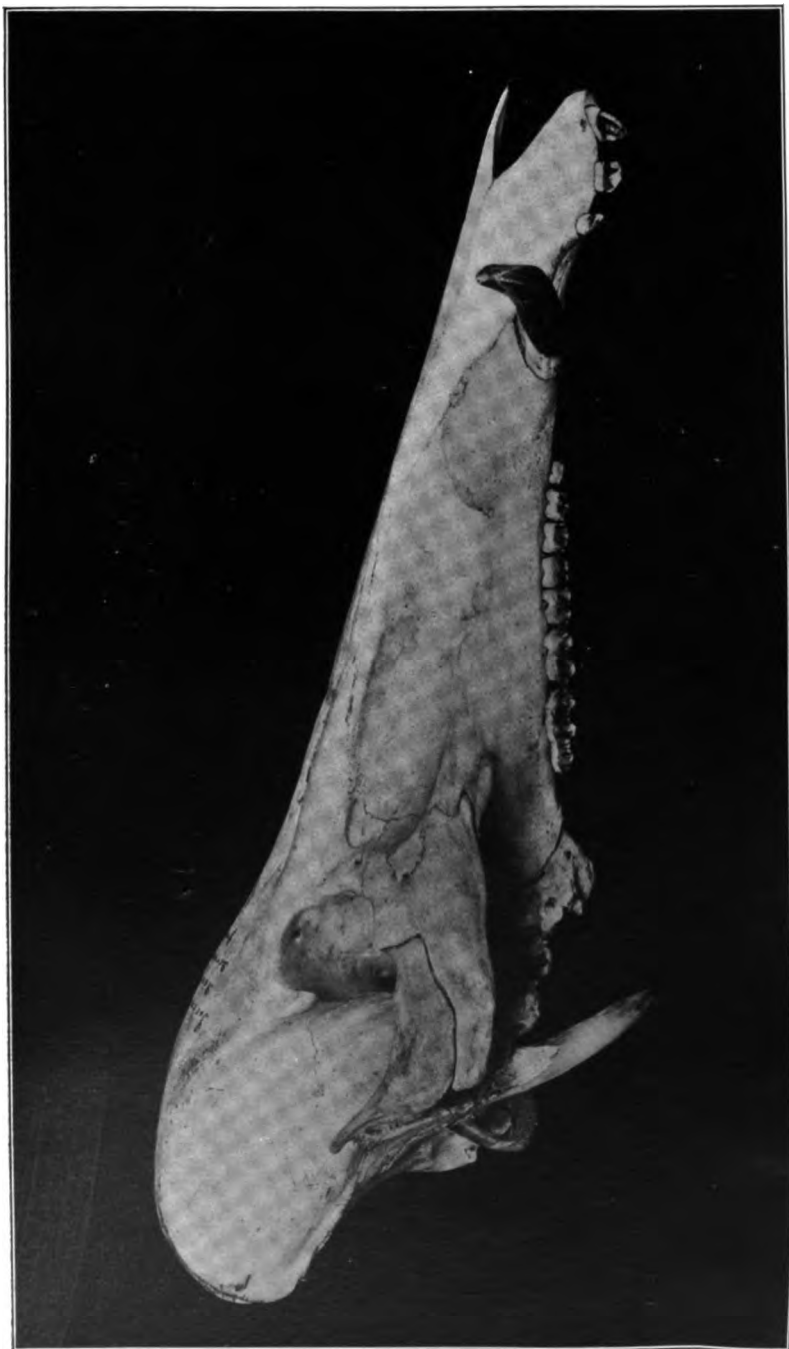




SUS OI. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 757.

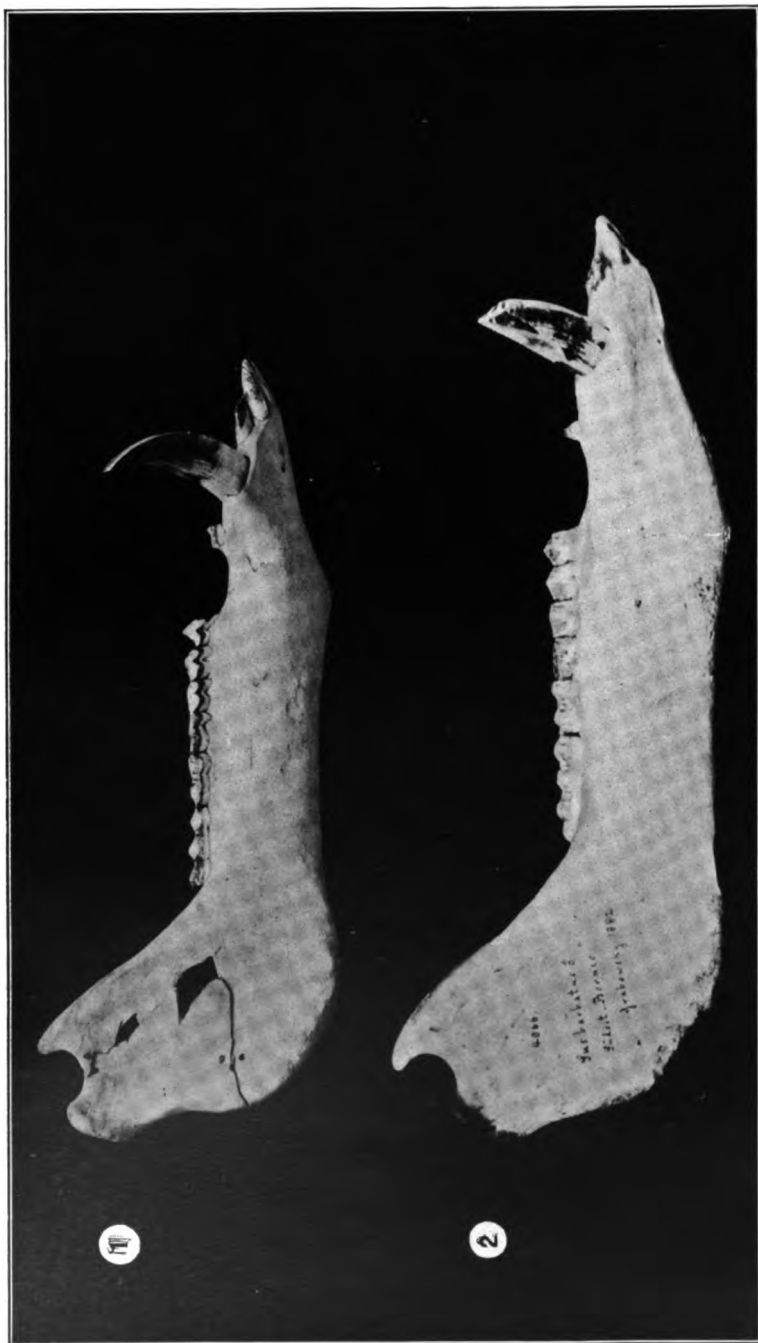




**SUS GARGANTUA. TYPE.**

FOR EXPLANATION OF PLATE SEE PAGE 757.





1. *SUS BARBATUS*.—2. *SUS GARGANTUA*. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 757.

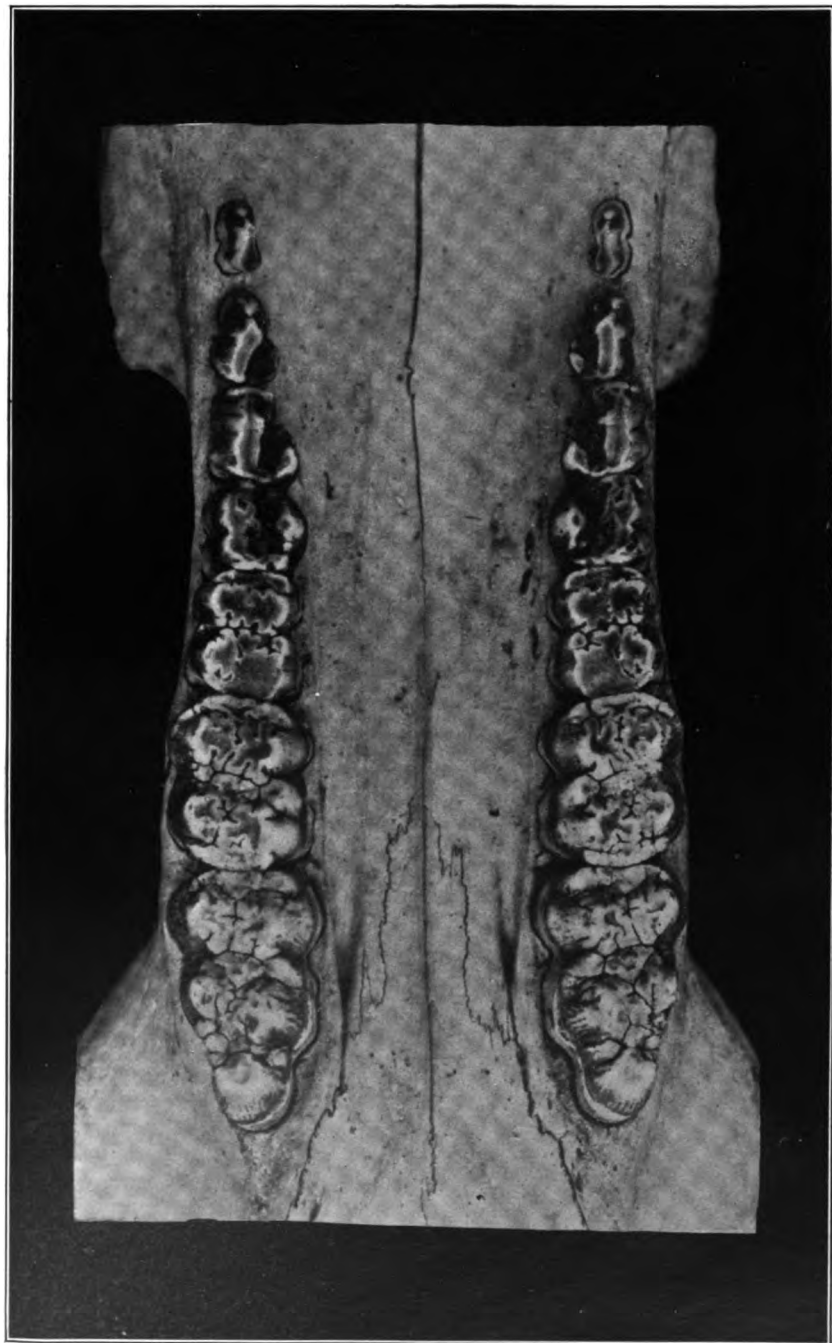




1. *SUS BARBATUS*.—2. *SUS GARGANTUA*. TYPE.—3. *SUS OI*. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 757.

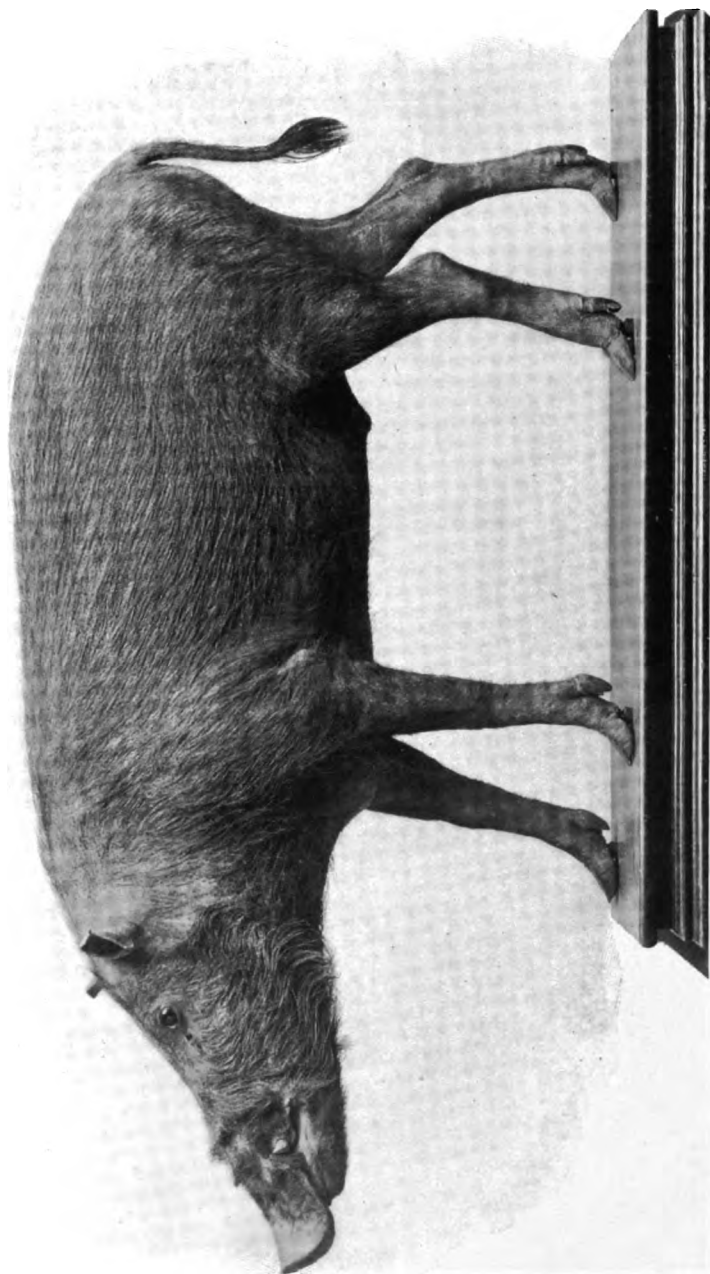




*SUS GARGANTUA*. TYPE.

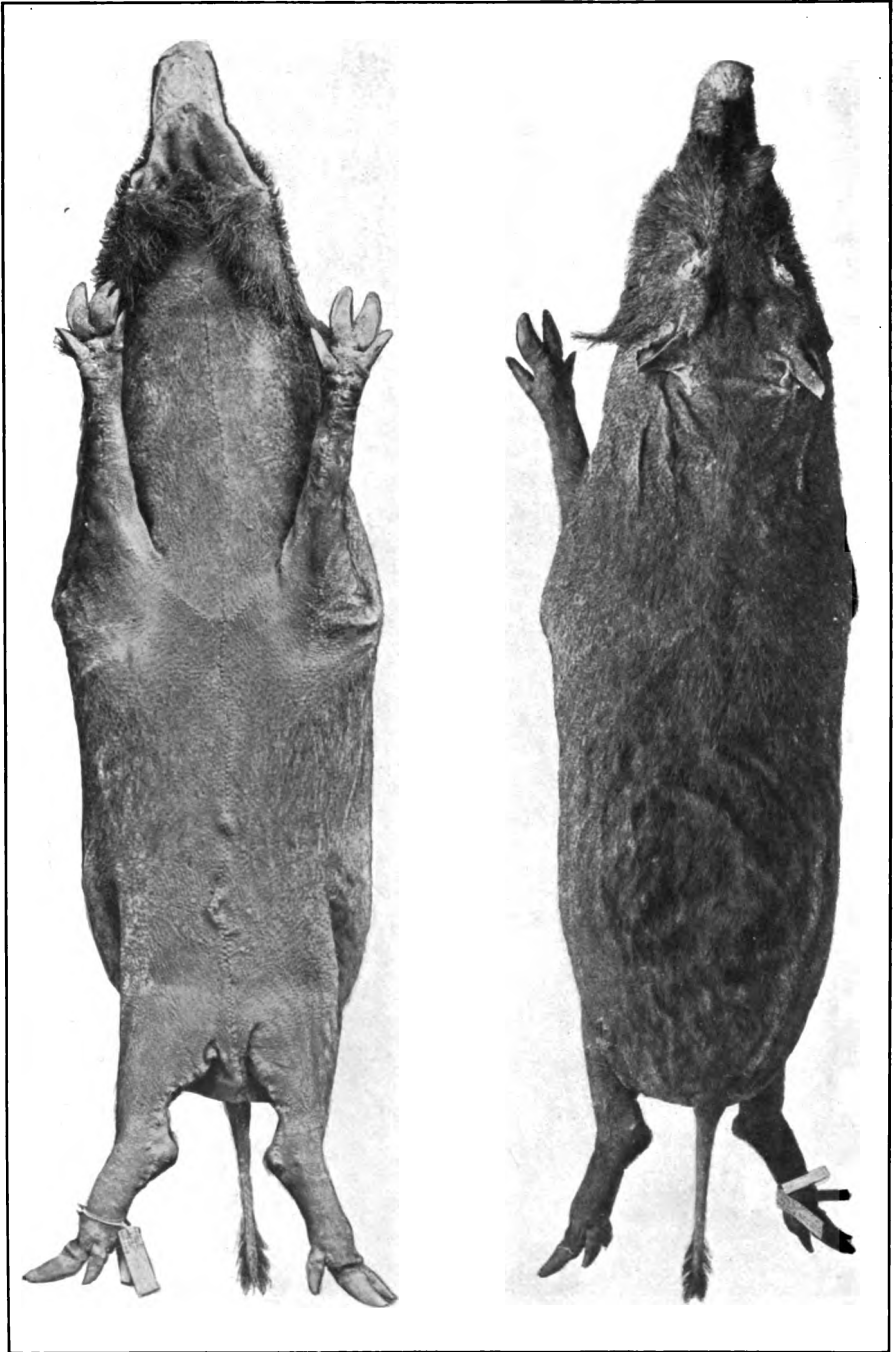
FOR EXPLANATION OF PLATE SEE PAGE 757.





**SUS BARBATUS.**  
FOR EXPLANATION OF PLATE SEE PAGE 757.

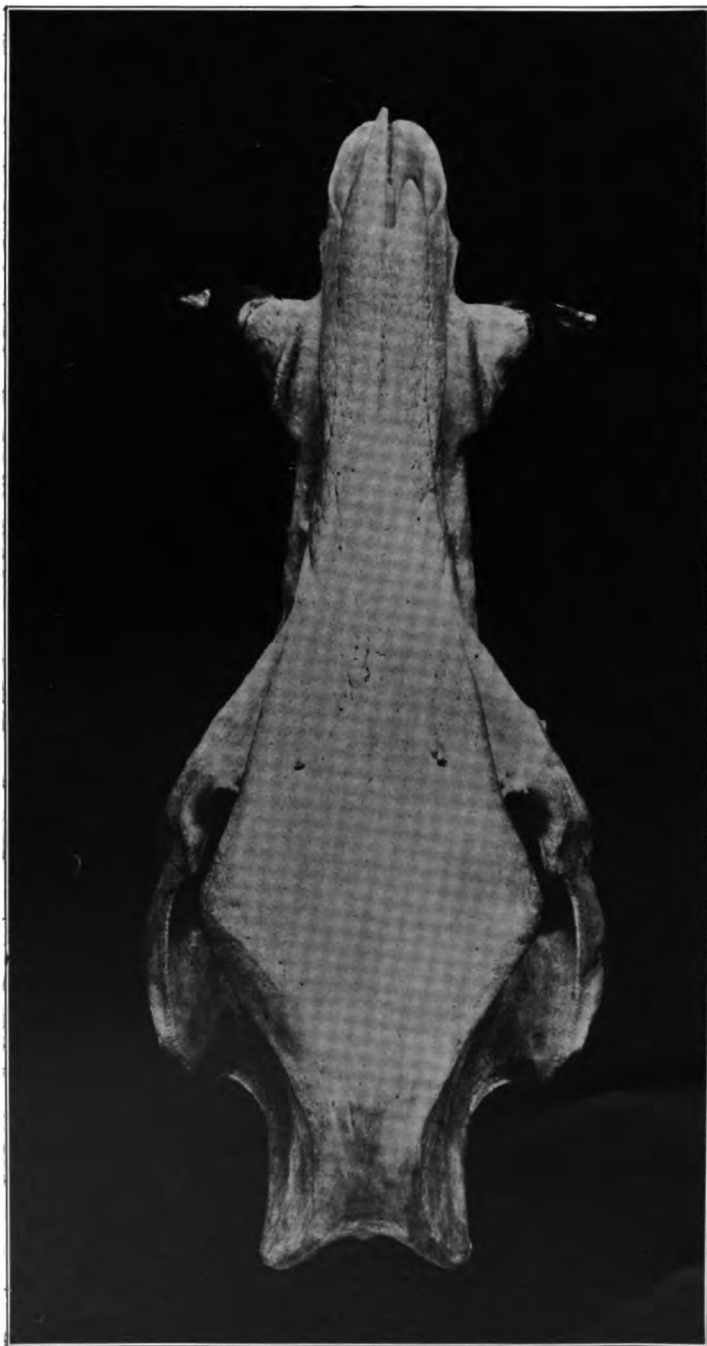




SUS OI. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 757.

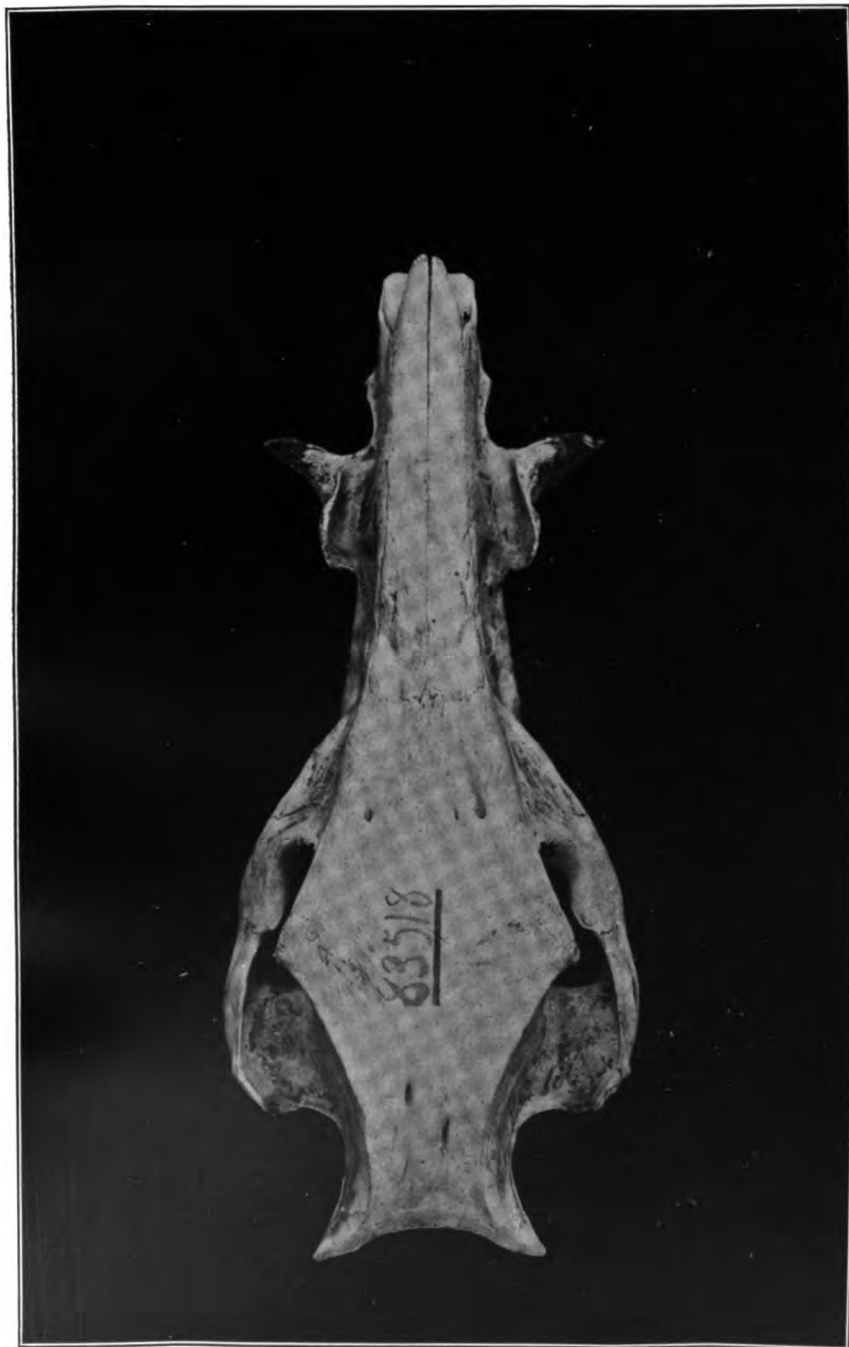




**SUS CRISTATUS.**

FOR EXPLANATION OF PLATE SEE PAGE 757.





*SUS JUBATUS*. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 758.





**SUS JUBATUS. TYPE.**

FOR EXPLANATION OF PLATE SEE PAGE 758.

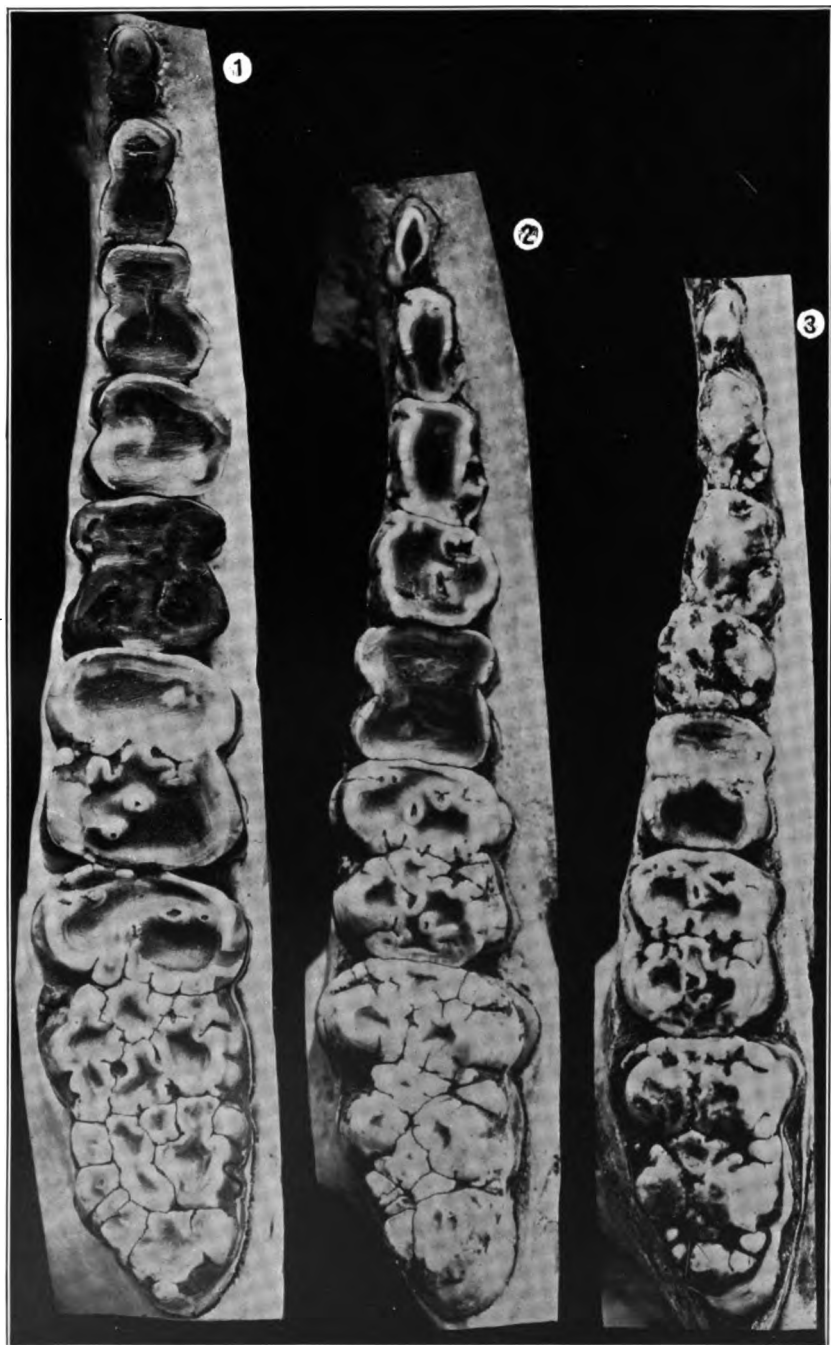




1. *SUS PENINSULARIS*—2. *SUS PENINSULARIS*.

FOR EXPLANATION OF PLATE SEE PAGE 758.

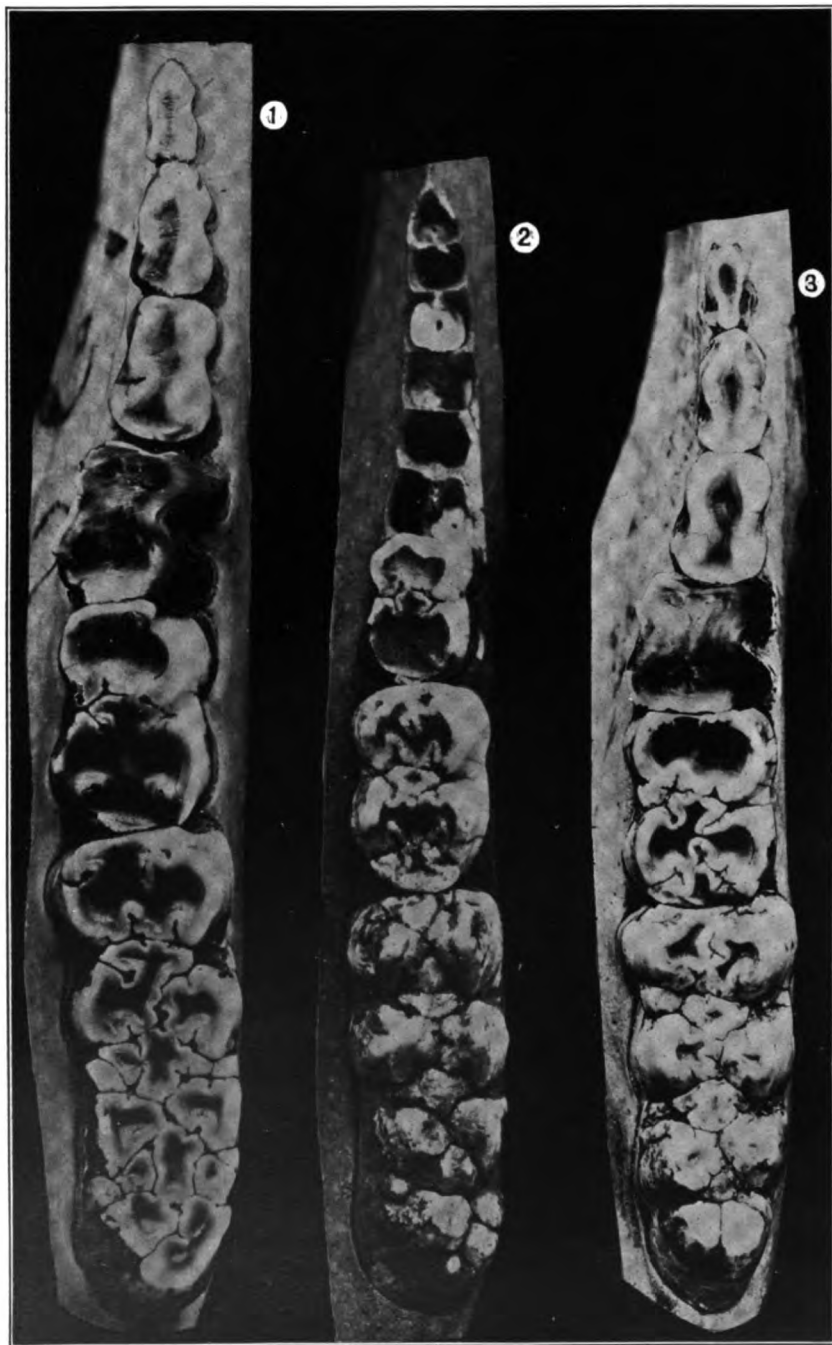




1. *SUS CRISTATUS*.—2. *SUS JUBATUS*. TYPE.—3. *SUS VITTATUS*.

FOR EXPLANATION OF PLATE SEE PAGE 758.

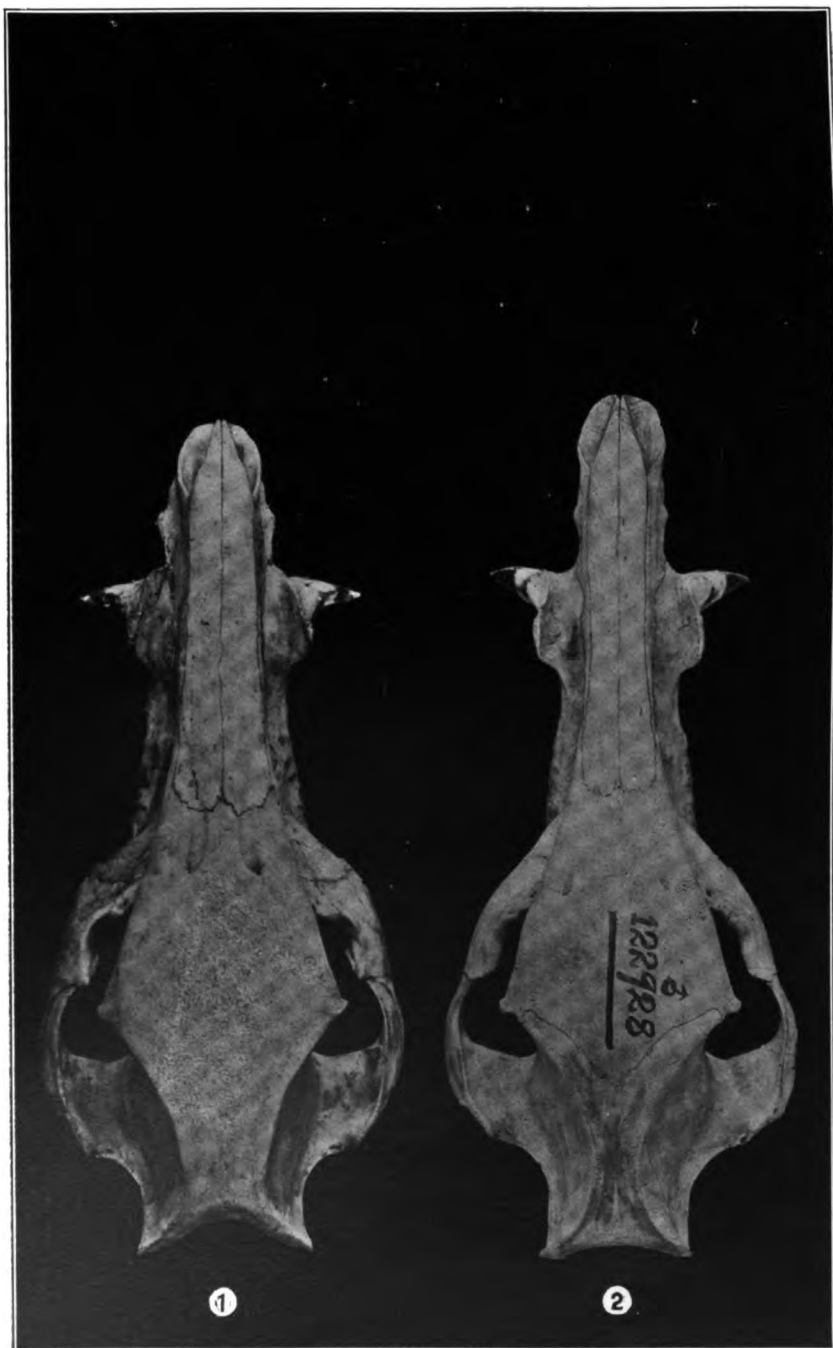




1, 2. *SUS CRISTATUS*.—3. *SUS JUBATUS*. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 758.

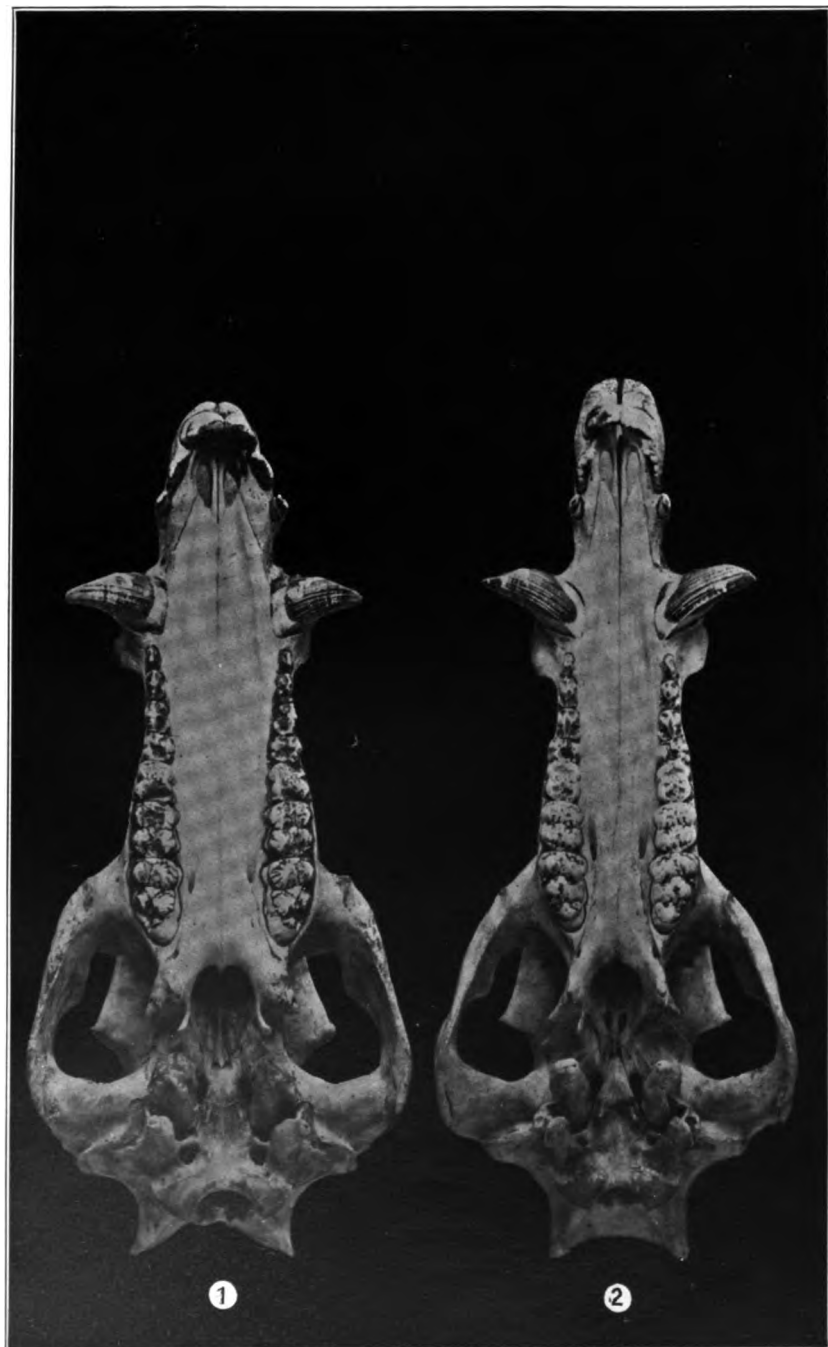




1. *SUS BABI*. TYPE.—2. *SUS RHIONIS*. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 758.

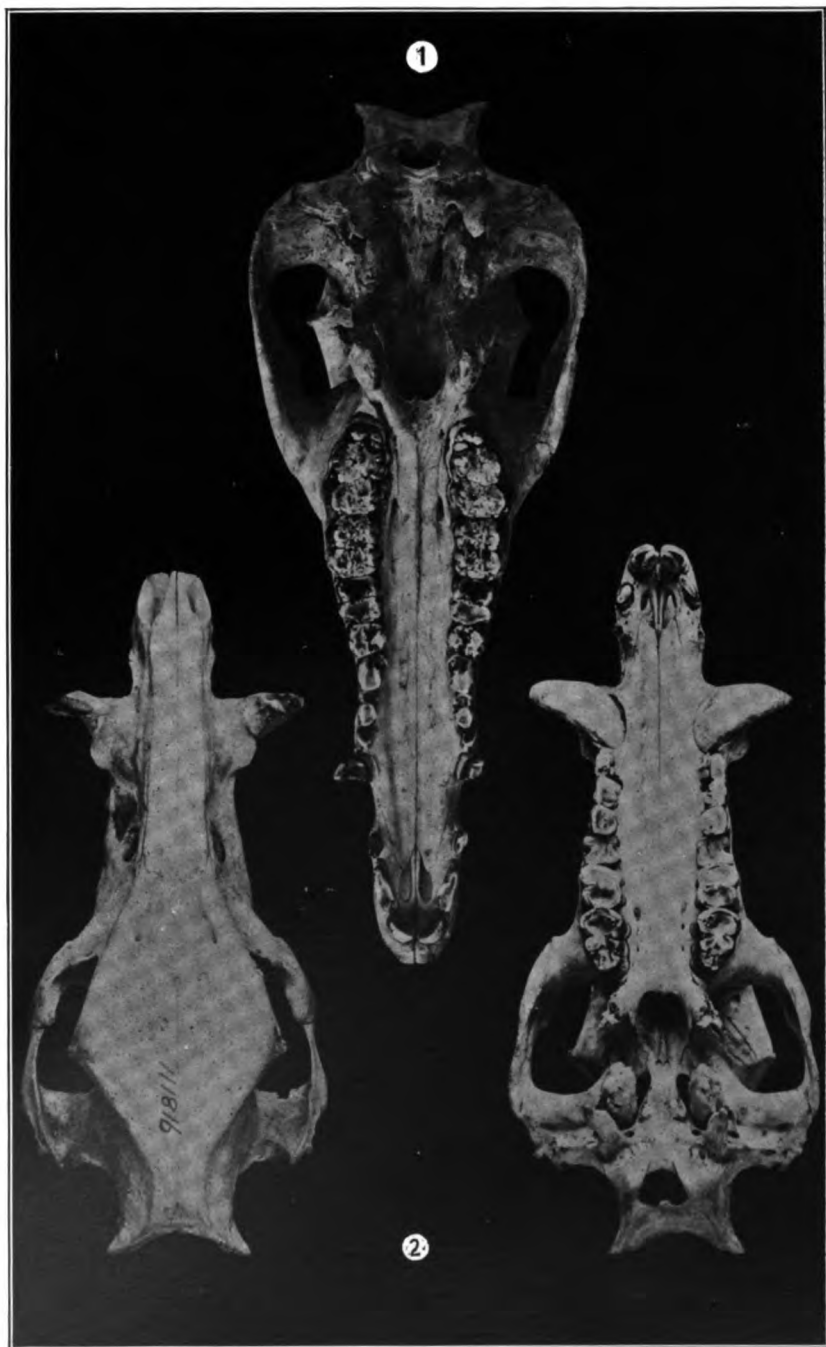




1. *SUS BABI*. TYPE.—2. *SUS RHIONIS*. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 758.





1. *SUS NIADENSIS*. TYPE.—2. *SUS ANDAMANENSIS*.

FOR EXPLANATION OF PLATE SEE PAGE 758.





1. *SUS NIADENSIS*.—2. *SUS OI*.

FOR EXPLANATION OF PLATE SEE PAGE 758.





1. *SUS VITTATUS*.—2. *SUS NIADENSIS*. TYPE.—3. *SUS RHIONIS*. TYPE.

FOR EXPLANATION OF PLATE SEE PAGE 758.



## A NEW AMERICAN PENTREMITE

By CHARLES SCHUCHERT,  
*Of Yale University, New Haven, Connecticut.*

The new American *Pentremites* here described was found by Dr. S. W. McCallie, assistant State geologist of Georgia, in the Bangor limestone of Georgia, and several months ago was forwarded to the writer for description, and presented to the U. S. National Museum. Doctor McCallie has referred to the occurrence of this *Pentremites* in his Report on the Coal Deposits of Georgia,<sup>a</sup> where notes on the stratigraphy may be found.

### PENTREMITES MACCALLIEI, new species.

Theca elongate, conical, and very large, having a length of 57 mm. and a width of about 40 mm. Base inverted-cone shaped, large, rapidly

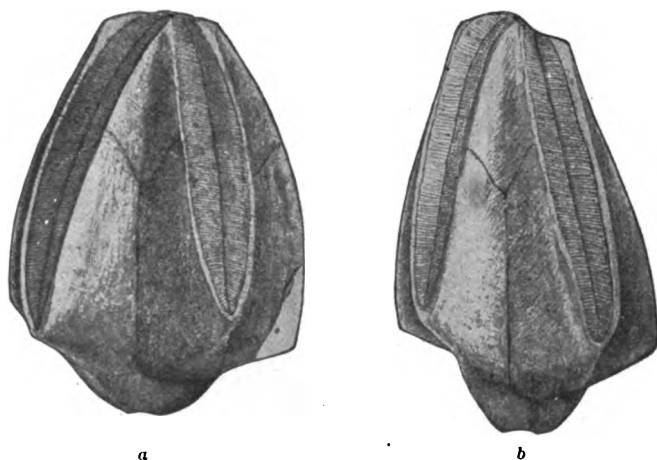


FIG. 1.—a, THE DISTORTED SPECIMEN OF *PENTREMITES MACCALLIEI* SLIGHTLY TILTED SO AS TO BRING OUT MORE NEARLY THE NORMAL FORM. NATURAL SIZE. b, SIDE VIEW SHOWING AMOUNT OF DISTORTION.

expanding, a little less than one-fourth the total length of theca, deeply pentalobate and with the basal plates sharply delimited from

<sup>a</sup> Geol. Surv. Georgia, Bull. No. 12, 1904, p. 16.

the radials. Ambulacra very large, three-fourths the length of the theca, with flat sides sloping down to the depressed median groove. Length of each ambulacrum about 45 mm., greatest width about 9 or 10 mm. There are about 25 ambulacral grooves in 10 mm. Interambulacral areas deeply and angularly indented. Deltoids very long and narrow.

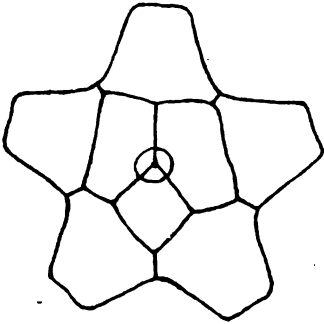


FIG. 2.—BASAL VIEW OF PENTREMITES MACCALLIEI IN OUTLINE, RESTORED TO PROBABLE NORMAL FORM.

end is longer and more attenuate. The deltoids also are correspondingly longer and narrower. The recently described *P. fohsi*<sup>a</sup> has similar ambulacra and equals *P. maccalliei* in size but differs decidedly in having flat instead of deeply concave interambulacral spaces. Finally, *P. obesus* Lyon, an even larger species, while being similarly pentalobate in cross section, has very different ambulacra, these being biconvex in transverse contour, as in *P. godoni* De France and its allies. As the new species is based on a single mature example, nothing can be given regarding the developmental changes.

*Formation and locality.*—The specimen was found by Dr. S. W. McCallie in the Bangor limestone in an old lime quarry in Nickajack gulch, a short distance below the coke ovens at Cole City, Georgia.

*Holotype.*—Cat. No. 35689, U.S.N.M.

*Remarks.*—In the structure of the ambulacra, the deep interambulacral areas, and form of basal half, the new species agrees very nearly with *P. sulcatus* Roemer. It differs, however, in being twice as large as the average adult specimen of that species, and in the more important particular that its apical



FIG. 3.—SECTION OF PENTREMITES MACCALLIEI ACROSS AN AMBULACRAL FURROW, SHOWING THE VERY SLIGHT CONVEXITY OF THE SLOPES ON EITHER SIDE OF THE MEDIAN GROOVE.

<sup>a</sup> Ulrich, U. S. Geol. Surv., Prof. Paper No. 36, 1905, pl. vii, figs. 5 to 9.

# ON A COLLECTION OF FISHES MADE BY P. O. SIMONS IN ECUADOR AND PERU.

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By EDWIN CHAPIN STARKS,  
*Of Stanford University, California.*

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The collection on which this paper is based includes both marine and fresh-water species, and was made by the late Mr. P. O. Simons, in Ecuador and Peru, during the winter of 1898 and 1899.

With one or two exceptions the marine fishes were collected at Guayaquil, Ecuador, and Callao, Peru. They illustrate very well the faunal relations of these localities. Guayaquil lies about equidistant between Panama and Callao, but belongs distinctly to the faunal region of Panama and northward.

All of the 44 species that were taken at Guayaquil are also found at Panama, with the exception of three species described as new from Guayaquil and one species of the southern fauna not extending north of Guayaquil (mentioned below). Sixteen of these have not been taken north of Panama and 24 extend their range to the Gulf of California.

Of the 34 species collected at Callao 23 have not been taken farther north, 11 have been taken north to the Gulf of California, and the other one not north of Guayaquil.

Thus it appears that with a single exception the fishes extending their range north of Callao are species of wide distribution. Five of the eleven can not perhaps fairly be considered in this connection. *Sphyrna zygaena*, *Scomber japonicus*, *Sarda chilensis*, *Caulolatilus princeps* are of such very wide distribution, and *Anisotremus scapularis* was, with little doubt, erroneously reported from Mexico.

The species of Guayaquil are in all cases very much darker than the same species from Panama, making it appear probable that the faunas of these two localities, though similar, do not intermingle.

The drawings for this paper were made by Chloe Lesley Starks.

Table of distribution.

| Name.                                    | Callao,<br>Peru. | Guaya-<br>quil,<br>Ecuador. | Panama. | Gulf of<br>Californ-<br>ia. |
|--|------------------|-----------------------------|---------|-----------------------------|
| <i>Carcharias azureus</i> .....          |                  | x                           | x       |                             |
| <i>Carcharias cerdale</i> .....          |                  | x                           | x       |                             |
| <i>Sphyrna zygaena</i> .....             | x                | x                           | x       | x                           |
| <i>Sphyrna tiburo</i> .....              |                  | x                           | x       | x                           |
| <i>Rhinobatus leucorhynchus</i> .....    |                  | x                           | x       | x                           |
| <i>Callorhynchus callorhynchus</i> ..... | x                |                             |         |                             |
| <i>Felichthys panamensis</i> .....       |                  | x                           | x       | x                           |
| <i>Galeichthys simonsi</i> .....         | x                |                             |         |                             |
| <i>Lepidarius dowi</i> .....             |                  | x                           |         |                             |
| <i>Netuma kessleri</i> .....             |                  | x                           | x       |                             |
| <i>Tachysurus equatorialis</i> .....     |                  | x                           |         |                             |
| <i>Ophichthus callaensis</i> .....       | x                |                             |         |                             |
| <i>Elops saurus</i> .....                |                  | x                           | x       | x                           |
| <i>Potamalosea notacanthoides</i> .....  | x                |                             |         |                             |
| <i>Sardinella fimbriata</i> .....        | x                |                             |         |                             |
| <i>Ilisha furthi</i> .....               |                  | x                           | x       |                             |
| <i>Tylosurus jordani</i> .....           |                  | x                           |         |                             |
| <i>Syngnathus starksii</i> .....         |                  | x                           |         | x                           |
| <i>Kirlandia pachylepis</i> .....        |                  | x                           | x       |                             |
| <i>Basilichthys regillus</i> .....       | x                |                             |         |                             |
| <i>Mugil curema</i> .....                |                  | x                           | x       | x                           |
| <i>Mugil hospes</i> .....                |                  | x                           | x       |                             |
| <i>Polydactylus approximans</i> .....    | x                | x                           | x       | x                           |
| <i>Scomber japonicus</i> .....           |                  | x                           |         | x                           |
| <i>Sarda chilensis</i> .....             | x                | x                           | x       | x                           |
| <i>Oligoplites mundus</i> .....          |                  | x                           | x       | x                           |
| <i>Neptomenus crassus</i> .....          | x                |                             |         |                             |
| <i>Caranx hippos</i> .....               |                  |                             | x       | x                           |
| <i>Vomer scipinnis</i> .....             | x                | x                           | x       | x                           |
| <i>Selene vomer</i> .....                |                  | x                           | x       | x                           |
| <i>Trachinotus kennedyi</i> .....        |                  | x                           | x       | x                           |
| <i>Trachinotus paloma</i> .....          | x                |                             | x       | x                           |
| <i>Oxylabrax armatus</i> .....           |                  | x                           | x       |                             |
| <i>Paralabrax humeralis</i> .....        | x                |                             |         |                             |
| <i>Paralabrax callaensis</i> .....       | x                |                             |         |                             |
| <i>Lutjanus argentiventris</i> .....     |                  | x                           | x       | x                           |
| <i>Anisotremus pacifici</i> .....        |                  | x                           | x       |                             |
| <i>Anisotremus scapularis</i> .....      | x                |                             |         | a x                         |
| <i>Isacia conceptionis</i> .....         |                  |                             |         |                             |
| <i>Isacia venusta</i> .....              | x                |                             |         |                             |
| <i>Pomadasys burro</i> .....             |                  | x                           |         |                             |
| <i>Eucinostomus californiensis</i> ..... |                  | x                           | x       | x                           |
| <i>Gerres peruvianus</i> .....           | x                | x                           | x       | x                           |
| <i>Doydirodon lieifrons</i> .....        |                  |                             |         |                             |
| <i>Archoscion analis</i> .....           | x                |                             |         |                             |
| <i>Cynoscion albus</i> .....             |                  | x                           | x       |                             |
| <i>Bairdiella chrysopleuca</i> .....     |                  | x                           | x       |                             |
| <i>Bairdiella ensifera</i> .....         |                  | x                           | x       |                             |
| <i>Stellifer minor</i> .....             | x                |                             |         |                             |
| <i>Sciaena fasciata</i> .....            | x                |                             |         |                             |
| <i>Sciaena deliciosa</i> .....           | x                |                             |         |                             |
| <i>Sciaena gilberti</i> .....            | x                |                             |         |                             |
| <i>Polyclemus peruanus</i> .....         | x                |                             |         |                             |
| <i>Micropogon altipinnis</i> .....       |                  | x                           | x       |                             |
| <i>Chilodactylus variegatus</i> .....    | x                |                             |         |                             |
| <i>Chromis crisma</i> .....              |                  |                             |         |                             |
| <i>Chaetodipterus zonatus</i> .....      |                  | x                           | x       | x                           |
| <i>Parapsellus panamensis</i> .....      |                  | x                           | x       |                             |
| <i>Balistes naufragium</i> .....         |                  | x                           | x       | x                           |
| <i>Spheroides furthi</i> .....           |                  | x                           | x       |                             |
| <i>Philypnus lateralis</i> .....         | x                | x                           | x       | x                           |
| <i>Eleotris picta</i> .....              |                  | x                           | x       | x                           |
| <i>Mapo soporator</i> .....              | x                | x                           | x       | x                           |
| <i>Gobionellus sagittula</i> .....       |                  | x                           | x       | x                           |
| <i>Caulolatilus princeps</i> .....       | x                |                             |         |                             |
| <i>Batrachoides pacifici</i> .....       |                  | x                           | x       |                             |
| <i>Labrisomus philippi</i> .....         | x                |                             |         |                             |
| <i>Hypoleurochilus puytensis</i> .....   |                  |                             |         |                             |
| <i>Paralichthys adspersus</i> .....      | x                |                             |         |                             |
| <i>Citharichthys gilberti</i> .....      |                  | x                           | x       | x                           |

a Probably erroneously reported from Mazatlan by Peters.

The following ten species are here described as new.

| Name.                                   | U. S. N. M.<br>type<br>number. | Name.                              | U. S. N. M.<br>type<br>number. |
|---|--------------------------------|------------------------------------|--------------------------------|
| <i>Galeichthys simonsi</i> .....        | 53466                          | <i>Neptomenus crassus</i> .....    | 53465                          |
| <i>Tuchysurus equatorialis</i> .....    | 53470                          | <i>Paralabrax callaensis</i> ..... | 53471                          |
| <i>Rhamdia gilli</i> .....              | 53472                          | <i>Isacia venusta</i> .....        | 53467                          |
| <i>Prochilodus caudifasciatus</i> ..... | 53473                          | <i>Sciæna gilberti</i> .....       | 53464                          |
| <i>Tylosurus jordani</i> .....          | 53469                          | <i>Pomadourys burro</i> .....      | 53468                          |

### Family GALEIDÆ.

#### 1. CARCHARIAS AZUREUS Gilbert and Starks.

A specimen considerably larger than the type, and agreeing with it very well in all essential characters, was collected at Guayaquil, Ecuador. It was preserved in alcohol as a partially skinned specimen. As in the type, the claspers are undeveloped and fail to reach to the posterior margin of the ventral fins.

#### 2. CARCHARIAS CERDALE (Gilbert).

Three small specimens from Guayaquil agree very well with the typical specimens from Panama.

### Family SPHYRNIDÆ.

#### 3. SPHYRNA ZYGÆNA (Linnæus).

One specimen from Callao, Peru.

#### 4. SPHYRNA TIBURO (Linnæus).

A specimen collected at Guayaquil, Ecuador. Although this species was not reported from the Pacific until 1895, it appears to be as common as *S. tudes*, and will probably be found to have as wide a range, at least in American waters.

### Family RHINOBATIDÆ.

#### 5. RHINOBATUS LEUCORHYNCHUS (Günther).

A specimen 43 cm. in length from Guayaquil, Ecuador. It differs from a specimen from Panama, 38 cm. in length, in having the snout more blunt, the rostral ridges not so narrow, and the lateral edge of disk a little more concave. In all of these respects about intermediate between the Panama specimen and a specimen of *R. glaucostigma* from Mazatlan, 57 cm. long. It has no trace, however, of the characteristic slate-colored spots on the back or the dark blotch under the tip of the snout of *R. glaucostigma*. Both specimens of *R. leucorhynchus* have the dorsals darker than in *R. glaucostigma*, and the shagreen appears to be a little rougher and coarser.

## Family CHIMÆRIDÆ.

6. *CALLORHYNCHUS CALLORHYNCHUS* Linnæus.

A specimen 67 cm. in length was collected at Callao, Peru. It differs in no essential characters from a specimen of this species from New Zealand in the Stanford University collections.

Body strongly compressed, twice as high as thick below first dorsal spine, where it is one-fourth of entire length to base of upper caudal lobe. Body thence tapering rapidly back to the rather slender caudal peduncle. Upper anterior profile forming an even, moderate curve to a point in front of and on a level with eye, where it is very slightly produced. Eye contained  $3\frac{1}{2}$  times in the space obliquely upward from its posterior margin to base of dorsal spine, and situated midway between dorsal spine and tip of snout (without rostral process). Dental plates agreeing well with the picture published by Garman.<sup>a</sup>

Front of pectoral one diameter of eye behind front of dorsal spine. Base of first dorsal contained  $2\frac{1}{2}$  times in space between dorsals; base of second dorsal equal to this space and equal to depth of body under dorsal spine. Posterior end of base of ventral under front of second dorsal. Tip of pectoral when fin is held close to body reaches to posterior end of ventral base.

Color dark silvery with large, obscure, dark, round blotches on upper part of side and back; one series of these along lateral line and traces of one below. A broken, dark band connects the dorsals and is separated from its fellow of the opposite side by a light streak on median line of back. A large, dusky blotch below eye; one on each side of dorsal spine; one on opercular region, and one above base of ventral. Fins all dark. These markings are all more conspicuous on the New Zealand specimen.

## Family SILURIDÆ.

7. *FELICHTHYS PANAMENSIS* (Gill).

A specimen 20 cm. in length from Guayaquil differs from specimens from Panama only in having the barbels a little longer and the dorsal shield a little wider and more deeply sculptured. The width of the dorsal shield measured from side to side, without considering the transverse curve of the back, is one-third of the length of the head. The maxillary barbel reaches to the middle of the ventrals; the pectoral filament to the middle of the anal.

8. *GALEICHTHYS SIMONSI*, new species.

Head,  $3\frac{1}{2}$  in length without caudal; depth, 5. Eye,  $6\frac{1}{2}$  in head; snout,  $2\frac{1}{2}$ ; width between angles of mouth,  $2\frac{1}{2}$ ; width of head,  $1\frac{1}{2}$ ; dorsal spine,  $1\frac{1}{2}$ ; first dorsal ray,  $1\frac{1}{2}$ ; pectoral spine,  $1\frac{1}{2}$ ; ventral fin,  $2\frac{1}{2}$ ; long-

<sup>a</sup> Bull. Mus. Comp. Zool., XLI, No. 2, pl. vii.

est anal ray,  $2\frac{1}{2}$ ; base of adipose dorsal,  $\frac{1}{2}$ ; depth of caudal peduncle, 4. Dorsal, 1, 6; anal, 16.

Upper anterior profile nearly straight to above eyes, thence slightly convex to tip of snout. Top of head more evenly granular than in *G.*

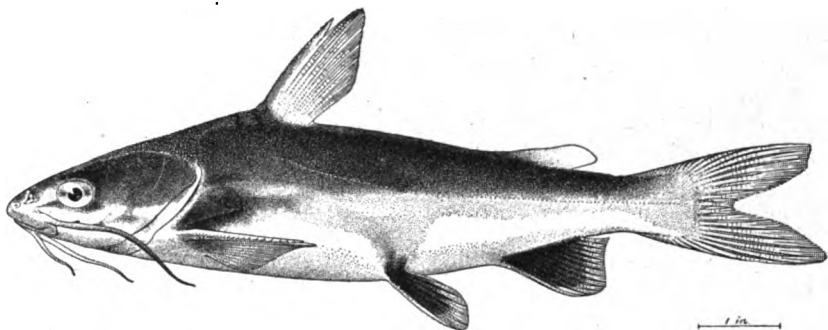


FIG. 1.—GALEICHTHYS SIMONSI.

*jordani*, the granulated area not irregularly striated anteriorly and extending farther forward, or to above front of pupil in the usual two diverging points. Fontanel groove reaching to within half a diameter of the eye of the occipital process. The groove tapers at both ends, and is not wider anteriorly; at its middle, where it enters the granulated area, it is slightly constricted. The ridge of the occipital process

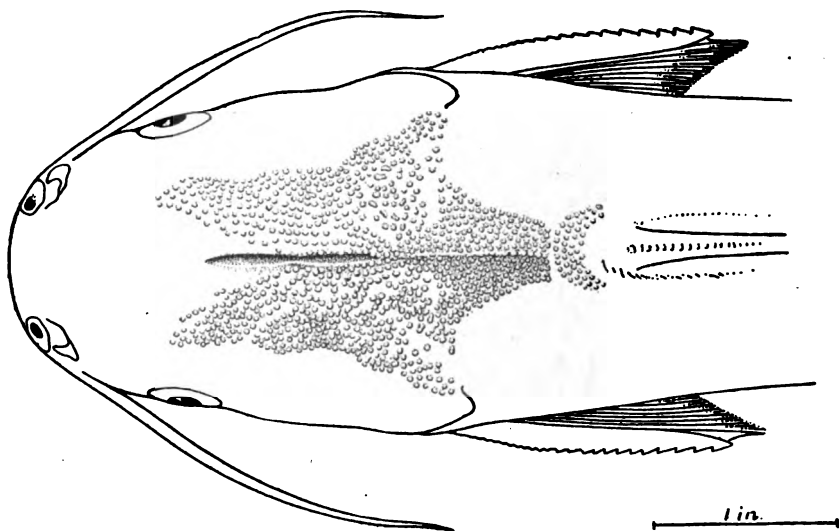


FIG. 2.—GALEICHTHYS SIMONSI.

is not so sharp and high, the sides more gently sloping than in *G. jordani*; the width of the process equals its length. The snout, as viewed from above, is more truncate than in *G. jordani*; the eye is a little larger. The palatine patches of teeth are smaller, more diverging, and

not so nearly rounded; the width of each patch is half its length. The vomerine patches are not separated, though notched at the median line before and behind.

Maxillary barbel reaching just past base of pectoral spine, not quite to pectoral pore; postmental barbels to edge of branchiostegal membrane; mental barbels two-thirds of the distance from their base to edge of branchiostegal membrane. Pectoral pore very small. Humeral spine more slender than in *G. jordani*, and more concave on upper edge, making its point more acute. Gill rakers, 5+10.

Color very dark brown, nearly black on upper parts; lower parts silvery white. The dark color of back gradually changing to the white of lower parts on body, but on anterior part of head the dark color extends down to a little below eye and changes abruptly to white; the change is more gradual on opercular region. A large black spot just behind gill opening covers humeral spine. Base of dorsal spine dark, the rest of the fin pale, adipose dorsal dusky only at base. A jet black blotch covers nearly the entire anal fin, beginning sharply at the base of the fin in strong contrast with the pure white of body just above, leaving a narrow light border along the anterior edge of fin, and a broader one across tips of rays. A similar spot on ventrals, but diffused upward into the silvery white of belly, extending farther toward tips of rays on upper surface of fin than on lower. Upper surface of pectoral dark at base of rays, becoming lighter toward ends of rays, not nearly so dark as on other lower fins except on a small region at base. Lower surface of pectoral slightly dusky. Caudal without color. Maxillary barbel black.

The type and sole specimen was collected at Callao, Peru. It is 255 mm. in entire length, and is deposited in the U. S. National Museum, Cat. No. 53466.

This species is named for Mr. P. O. Simons, whose life was lost while making this and other collections in South America.

#### 9. LEPTARIUS DOWI Gill.

A single specimen from Guayaquil does not differ from Panama specimens.

#### 10. NETUMA KESSLERI (Steindachner).

A single specimen collected at Guayaquil. It has been compared with specimens from Panama and found to differ in no particular.

#### 11. TACHYSURUS EQUATORIALIS, new species.

Head,  $3\frac{2}{3}$  in length to base of caudal; depth,  $5\frac{1}{2}$ . Eye, 5 in head; snout, 3; width between angles of mouth, 3; width of head,  $1\frac{1}{2}$ , length of dorsal spine,  $1\frac{1}{2}$ ; first dorsal ray,  $1\frac{1}{2}$ ; first pectoral ray,  $1\frac{1}{2}$ ; ventral fin,  $1\frac{1}{2}$ ; longest anal ray, 2; base of adipose dorsal, 3; depth of caudal peduncle, 3. Dorsal, I, 6; anal, 23.

Upper anterior profile appearing perfectly straight, and rather steeply sloping from the dorsal spine nearly to the tip of the snout, where it curves very slightly downward. Head as viewed from the

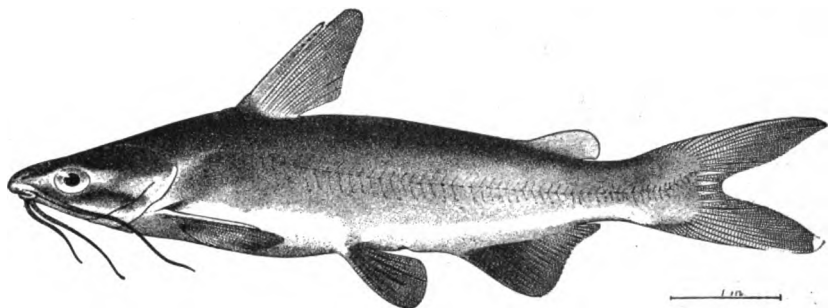


FIG. 3.—*TACHYSURUS EQUATORIALIS*.

side sharply wedge-shaped. Top of head very finely granular; the granulated area ends some distance behind the eyes, but is continued forward to a point on each side, as a slightly rugose surface covered by

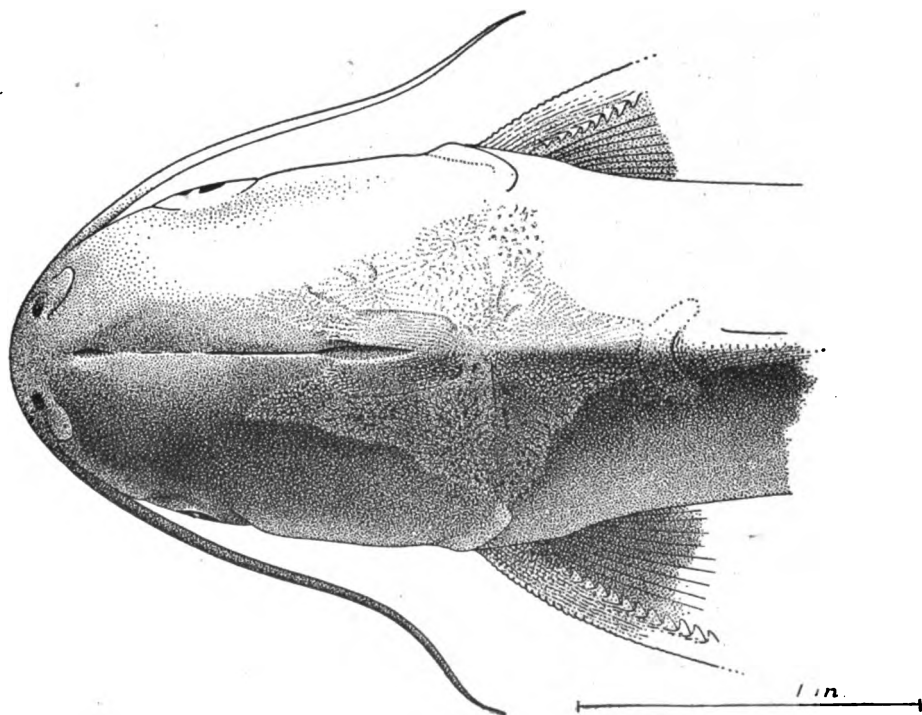


FIG. 4.—*TACHYSURUS EQUATORIALIS*.

thin skin, to opposite the posterior margin of the eyes. The fontanel groove fails to reach the occipital process by a distance equal to the vertical diameter of the eye; its widest and deepest part is where it

traverses the granulated area on top of head, where for a distance equal to the long diameter of the eye it is sharply defined, and as wide and deep as the base of the slender maxillary barbel. Posteriorly it ends in a point; anteriorly it is continued as a faint line with indefinitely rounded edges to in front of the eyes, where it abruptly becomes wider, deeper, and sharply defined for a short distance and ends opposite the posterior nostril. Occipital process as wide as its length with the addition of the median length of the very narrow dorsal plate. The keel of the occipital process is sharp and high, with a slightly concave area on each side of it; at a little behind the middle of its length its sides slope away from the median keel at an angle of 45°. Snout as viewed from above rather narrow and evenly rounded. Premaxillary band of teeth as long as eye and one-fifth as wide; palatine patches small, elliptical, and widely separated, each bearing about 30 bluntly rounded teeth; length of each patch two-fifths of length of eye and half as wide as long. Posterior, median, mandibular teeth not enlarged as in other species. Eye large; scarcely above level of mouth; the beginning of its posterior fifth at middle of length of head. Maxillary barbel reaching to axillary pore; postmental barbel to base of pectoral spine; and mental barbel to base of branchiostegal membrane. Branchiostegal membrane forming a fold across isthmus. Gill rakers rather long and slender; those near angle of arch half as long as eye; 6 + 13 in number.

Pectoral reaching to opposite base of last dorsal ray; the ventrals not quite to front of anal. Anal high anteriorly; its posterior edge very slightly concave; its last ray coterminous with tip of adipose dorsal. Posterior end of base of adipose dorsal two-thirds of head's length from base of caudal rays.

Color very dark brown above, changing gradually on sides to dirty white on lower parts; head dark to below eye; barbels all black; dorsal and adipose dorsal dusky; anterior half of anal growing lighter behind; upper surface of ventral and pectoral blue black; the former growing lighter toward ends of rays; their lower surface dusky; caudal dusky.

This species appears to be related to *T. steindachneri*, but not closely. The eye is much larger, the occipital process much sharper, the fontanel not so large; the profile straighter and steeper; the head sharper; and the character of the mandibular teeth different.

The type and sole specimen of this species was collected at Guayaquil, Ecuador. It is 193 mm. in length and is deposited in the U. S. National Museum, Cat. No. 53470.

## 12. RHAMDIA GILLI, new species.

Plate LXV, fig. 1.

Head, 4 to  $4\frac{1}{2}$  in length without caudal; depth,  $4\frac{1}{2}$  to  $4\frac{3}{4}$ . Eye, 5 in head; interorbital space, 3; bony part of interorbital space,  $3\frac{1}{2}$ ; width between angles of mouth, 3; width of head,  $1\frac{1}{2}$ ; dorsal spine,  $1\frac{1}{2}$ ; longest dorsal ray,  $1\frac{1}{2}$ ; pectoral spine,  $1\frac{1}{2}$ ; longest pectoral ray,  $1\frac{1}{2}$ ; longest ventral ray,  $1\frac{1}{2}$ ; base of dorsal,  $1\frac{1}{2}$ ; base of anal, 2; length of upper caudal lobe, 1; length of median caudal rays, 2; depth of caudal peduncle, 2. Dorsal, I, 6; anal, 11; ventral, 6.

Occipital process long and narrow, failing to reach the dorsal buckler by a space equal to half a diameter of pupil. Fontanel extending behind eye a distance equal to  $1\frac{1}{2}$  times diameter of eye. Its posterior portion separated from its anterior by a narrow bridge of bone opposite the posterior margin of eye. Snout rather narrow, and projecting slightly beyond tip of mandible; equal in length to postorbital part of head. Eye at middle of length of head and having a free border. Width of premaxillary band of teeth one-fourth its length; the band is not interrupted at its middle. Maxillary barbel reaching just past base of ventrals; mental barbel to base of pectoral fin; and postmental barbel to middle of pectoral spine.

Distance from tip of snout to insertion of dorsal contained  $2\frac{3}{4}$  times in length to base of caudal. Dorsal spine ending in a short ray-like filament that does not reach to tips of soft rays. When dorsal is reclined, the tips of its rays just fail to reach the front of adipose dorsal. The adipose dorsal is a very thin, high, fold of skin on a raised pedicle; its length contained  $3\frac{1}{2}$  times in the body length, and its height from the pedicle is one-fourth of length of head. The posterior end of its base is a little behind the tips of the anal rays, and it projects backward in a rounded lobe considerably beyond its base. The pectoral rays extend beyond the pectoral spine to below the base of the first dorsal ray. The ventrals extend two-thirds of the distance from their base to front of anal. Anal fin rounded behind, the distance from its base to base of median caudal rays is equal to length of head less half the diameter of eye. Upper lobe of caudal sharp and longer than the lower rounded lobe by a diameter of eye. Vent opposite middle of length of ventral rays.

Color dark brown with a diffused, rather wide, light band following lateral line; a large dark spot on opercle; fins all dusky; a dark line on membrane before each dorsal ray; adipose dorsal darker toward outer edges; anterior edge of maxillary barbel white, contrasting strongly with dark posterior edge; other barbels colorless.

This species seems to be more closely related to *Rhamdia jennynsii* (Günther) than to any other. It differs in having a larger head, a

much greater depth, a shorter anal, shorter maxillary barbels, and a light, rather than a dark, lateral band.

The type and one cotype were taken at Eten, Peru, in the Rio Eten. The type is 155 mm. in entire length and the cotype 110. The latter is deposited in the U. S. National Museum, Cat. No. 53472; the cotype in Stanford University Museum.

I take pleasure in naming this species for Dr. Theodore Gill.

13. *CETOPSIS OCCIDENTALIS* Steindachner.

Four specimens were taken at Guayaquil, the type locality of the species. They are from 16 to 26 cm. in length.

They agree very well with Dr. Steindachner's description of the type specimen except that the teeth on the vomer are in a single row anteriorly, and a double row posteriorly. In the type specimen they are said to be in a double row anteriorly and a triple row posteriorly.

Family PYGIDIIDÆ.

14. *PYGIDIUM DISPAR* Tschudi.

A single specimen 18 cm. in length taken at Eten, Peru.

Head contained  $4\frac{1}{2}$  times in length without caudal; its width less than its length by nearly 2 diameters of eye, and its depth at occiput is half its length. Depth of body contained 6 times in length. Body slender, tapering but little to the wide, thin, caudal peduncle, the depth of which is contained  $7\frac{1}{2}$  times in body length. Eye equidistant from tip of snout and edge of opercle; its length  $3\frac{1}{2}$  in postorbital part of head, and 3 times in interocular space. Width of premaxillary tooth patch one-sixth of its length; that of mandible a little narrower. Lips, and a region a short distance behind lower lip, slightly papillose. Upper maxillary barbel reaching just past preopercle, but scarcely to gill opening. Nasal barbel of same length but much more slender. Spines on lower edge of preopercle unequal in size; the longest ones one-half diameter of eye.

Dorsal with 12 rays, only 7 of which are branched; the others not evident until skin is dissected away in front of branched rays. Anal with 9 rays, only 5 branched. Origin of dorsal behind middle of body a distance equal to length of dorsal base; its first ray just behind base of ventrals, and its last ray a little in front of first anal ray. Distance from base of last anal ray to base of median caudal rays equal to length of head. Upper pectoral ray produced in a fine filament slightly beyond other rays; its length equal to length of head behind posterior nasal opening. Ventrals reaching a little more than half the distance between their base and first anal ray. Caudal truncate when fin is spread, but when its rays are parallel its posterior edge is slightly concave.

Body covered with large, nearly round, dark-brown spots, as large, or usually much larger, than long diameter of eye. On head and caudal fin they are smaller; on ventral surface just behind gill opening they are nearly faded out, but still evident. Anteriorly they are more crowded than toward the tail. Frequently two or more of them run together and form oblong spots.

15. *PYGIDIUM PUNCTULATUM* Cuvier and Valenciennes.

Five specimens were collected at Callao. *P. punctulatum* appears to differ from *P. dispar* in little but color. It is thickly covered with small, dark-brown spots not over half as large as in the latter species and about twice as numerous.

All of our specimens have one more branched ray in the dorsal, and the caudal peduncle scarcely so deep or compressed.

16. *PYGIDIUM RIVULATUM* Cuvier and Valenciennes.

A few half-grown specimens taken at Lake Titicaca agree very well with the description published by Eigenmann.<sup>a</sup>

The dorsal rays number 12, of which only 7 are branched and evident without dissecting. The anal has 11 rays, 6 or 7 of which are branched. The dark markings on the body have a decided purplish cast.

Family ARGIDÆ.

17. *ARGES SIMONSII* Regan.

There are four specimens of this species taken in the Peruvian Andes at an altitude of 7,200 feet. The label is so disintegrated that the exact locality can not be deciphered. The type locality (Huaras, Peru) is 10,700 feet in altitude.

These specimens agree very well with the original description of the species. The teeth are incisor-like and with entire edges in the front of both jaws. There are 5 or 6 teeth in the outer series on each side of the premaxillary and 4 or 5 on each side of the mandible. One specimen, a male, 75 mm. in length, is much deeper than the others, agreeing very well in this, as in other respects, with Regan's plate. The depth is  $5\frac{1}{4}$  in the length. The others, a male of about the same length and 2 females 90 mm. in length, have a depth of from  $6\frac{1}{4}$  to 7 in the length. There is no other essential difference between them. No spine was found in the adipose dorsal, though the skin was dissected away in this region in two specimens. There is no difference in the position of the ventrals between the sexes such as Evermann and Kendall report in *Cyclopium cyclopum*.<sup>b</sup>

<sup>a</sup> Cal. Acad. of Sci., Occasional papers, I, 1890, p. 332.

<sup>b</sup> Proc. Biol. Soc. Wash., XVIII, p. 91.

The origin of the ventrals is directly under that of the dorsal. The tips of the ventrals reach from five-sixths to one-half of the distance from their base to the front of anal.

### Family ERYTHRINIDÆ.

#### 18. HOPLIAS MICROLEPIS (Günther).

Four specimens from Guayaquil do not differ to any appreciable extent from specimens from Panama.

*H. microlepis* differs from *H. malabaricus* only in having a greater number of scales. This difference, though slight, appears to be very constant. Only two specimens of the latter species collected at Breves and Moraj, Tocantins River, Brazil, are at hand for comparison.

*H. microlepis* has 42 lateral line scales; 12 scales in a series running obliquely from base of ventral to base of dorsal; 13 series across back in front of dorsal from one lateral line to the other, not counting the pore-bearing scales or the few crowded scales in front of dorsal; 11 series counting in the same way behind dorsal; and 16 or 17 in a median line from occiput to dorsal. *H. malabaricus* has 38 lateral line scales; 11 series from ventral to dorsal; 11 series across back in front of dorsal; 9 behind dorsal; 14 from occiput to dorsal. There may be a constant difference in number of dorsal rays. Our two specimens of *H. malabaricus* have 15 dorsal rays, while *H. microlepis* has 13 or 14, usually the latter number.

Table of measurements of *Hoplias microlepis* and *Hoplias malabaricus*.

| Species.....                                      | <i>Hoplias microlepis</i> . |          |     | <i>Hoplias malabaricus</i> . |
|---|-----------------------------|----------|-----|------------------------------|
| Locality.....                                     | Panama.                     | Ecuador. |     | Brazil.                      |
| Length without caudal, in millimeters.....        | 210                         | 215      | 210 | 151                          |
| Head in hundredths of length.....                 | 32                          | 32       | 32  | 33                           |
| Depth.....  | 23                          | 22       | 21  | 23                           |
| Diameter of eye.....                              | 4                           | 4½       | 4½  | 4½                           |
| Width of interorbital space.....                  | 9                           | 8½       | 8½  | 9                            |
| Length of maxillary.....                          | 17                          | 16       | 16  | 17                           |
| Length of snout.....                              | 9                           | 8        | 8   | 8½                           |
| Distance from tip of snout to base of dorsal..... | 50                          | 51       | 51  | 51                           |
| Length of dorsal base.....                        | 17                          | 19       | 18  | 19                           |
| Length of fourth dorsal ray.....                  | 17                          | 18       | 17  | 17                           |
| Length of pectoral.....                           | 16                          | 16       | 17  | 16                           |
| Length of ventral.....                            | 17                          | 18       | 17  | 17                           |
| Length of caudal.....                             | 23                          | 25       | 24  | 22                           |
| Depth of caudal peduncle.....                     | 15                          | 14       | 14  | 14                           |

#### 19. LEBIASINA BIMACULATA Cuvier and Valenciennes.

Specimens taken at Callao and Eten, Peru, and at Santa Rosa, Ecuador. The following description is drawn from the Eten specimens from 15 to 18 cm. in length:

Head, 3½ to 4 in length to base of caudal; depth, 3½ to 4. Eye, 6 in head; snout, 4; interorbital space, 2½; longest dorsal ray, 1½; base

of dorsal, 3; longest anal ray, 2; base of anal, 2; length of pectoral,  $1\frac{1}{2}$ ; ventral,  $1\frac{1}{2}$ ; upper lobe of caudal,  $1\frac{1}{2}$ ; depth of caudal peduncle, 2. Dorsal, 10; anal, 11; ventral, 8. Scales, 25.

Front of head rounded in profile; fins all rounded; ventrals a little in advance of dorsal.

Color of specimens that had been a short time in formalin: Scales on dorsal part of body tinged with yellow; 3 rows of orange yellow spots, one on each scale, extending along side of body. Pectoral fin with a little orange coloring; ventral, anal, and caudal bright orange red; the color more brilliant near edges of fins. A dark lateral band ending anteriorly in a dark spot just behind opercle, and posteriorly in a darker more conspicuous spot at base of caudal; these markings more conspicuous in the young.

Some smaller specimens from Santa Rosa, Ecuador, differ in not having the small lateral spots, and in having a larger eye.

In the plate published by Cuvier and Valenciennes,<sup>a</sup> the dorsal is truncate across the ends of the rays, leaving the corners sharp. The dorsal should be broadly rounded and without angles. The caudal lobes are too sharp, and the lower jaw projects too much.

### Family CHARACINIDÆ.

#### 20. *CURIMATUS TROSCHELII* (Günther).

A single specimen taken in the market at Guayaquil. It agrees very well with Doctor Günther's description of the type.

#### 21. *PROCHILODUS CAUDIFASCIATUS*, new species.

Head,  $2\frac{1}{2}$  in length to base of caudal; depth,  $3\frac{1}{4}$ . Eye, between eyelids 7 in head; snout, 2; interorbital space, 2; third dorsal ray,  $1\frac{1}{2}$ ; base of dorsal,  $1\frac{1}{2}$ ; length of pectoral from base of first spine,  $1\frac{1}{2}$ ; second anal ray,  $1\frac{1}{2}$ ; base of anal,  $2\frac{1}{2}$ ; depth of caudal peduncle,  $2\frac{1}{2}$ . Dorsal, 12; anal, 10; ventral, 9. Scales, 47.

Eye with thin membranous eyelids; its anterior edge at the middle of the length of the head; the middle of the eye a little below the level of the angle of the mouth, and vertically equidistant from the dorsal and ventral outlines of head. Cavity beneath preorbital bone, into which maxillary elements retreat, fails to reach eye by a space half the diameter of eye. Maxillary elements forming a thick rounded projection beyond the mandible. When mouth is closed, its incision is directed obliquely in a line that if continued would extend through the center of eye. Teeth thin, small, and leaf like, in a single row at the outer edge of a thick spongy tissue that deeply covers the bones of the mouth; their edges outward toward edge of mouth. Near front of mouth on each jaw a single row of similar teeth curves inward and

<sup>a</sup> Hist. Nat. Poiss., pl. DLXXXVII.

backward, and, meeting its opposite fellow in a point directed down the throat, incloses a triangular area at front of mouth. The teeth of the inner row set transversely to those of the outer row. On the lower jaw the inclosed triangular area is much smaller than that in the upper jaw. Nostrils situated one diameter of eye in front of eye.

Pectoral reaching to within three-fourths of a diameter of eye of base of ventrals. Origin of dorsal midway between tip of snout and one scale behind base of adipose dorsal. Fourth dorsal ray longest, forming the point of fin; each dorsal ray with a thin lateral dermal flap extending nearly its whole length. Adipose dorsal inserted midway between base of dorsal and tips of median caudal rays; its base very short; its tip extending twice its height beyond its base posteriorly. Second anal ray the longest, 3 times the length of the last ray; posterior edge of anal somewhat lunate. Length of ventral equal to that of pectoral; its tip reaching a little more than two-thirds of the distance from base of its first ray to front of anal.

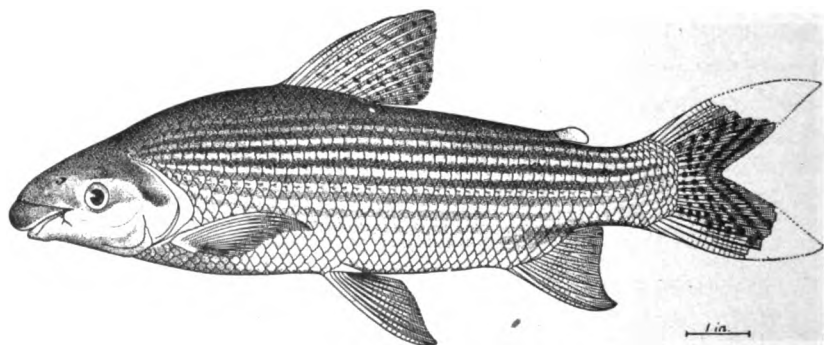


FIG. 5.—*PROCHILODUS CAUDIFASCIATUS*.

Surface of scales finely granular; 15 in a median row from front of dorsal to occiput;  $8\frac{1}{2}$  in an oblique row from front of dorsal to lateral line;  $6\frac{1}{2}$  from front of anal to lateral line.

Sides with alternate dark and silvery stripes following the rows of scales. Lateral line occupies a silvery stripe below which there are about 4 dark stripes fading into the silvery of the belly; about 5 dark stripes show above lateral line, and others are lost in dark color of back. Head dark to lower part of eye, silvery on sides below eye, and white on ventral surface. Maxillary elements dark; narrowly bordered with white on lip. Dorsal with spots on the rays, which form about 8 broken cross streaks. Caudal with several rather narrow dark cross streaks which posteriorly follow the edge of the forked caudal, but become more nearly vertical anteriorly; toward each edge of caudal some of the streaks fork and shorter streaks are introduced. No longitudinal median streak present on caudal. Anal very slightly tinged with dusky; ventral and pectoral colorless.

This species may be known by the elongate form, in connection with the number of scales, the length of head, and the bars on caudal. The species having the caudal barred are all deeper.

The type and only specimen is 32 cm. in entire length and was taken in the Rio Perené at Perené, Peru. It is deposited in the U. S. National Museum, Cat. No. 53473.

22. **LEPORINUS LESCHENAULTI** Cuvier and Valenciennes.

Two specimens collected at the market at Guayaquil. These unlike the specimens described by Doctor Günther<sup>a</sup> agree very well in length of head and depth of body with the figure published by Cuvier and Valenciennes. They have 39 or 40 scales in the lateral line; the type is said to have 36.

23. **TETRAGONOPTERUS PERUANUS** Muller and Troschel.

Specimens were taken from Rio de Eten, at Eten, and at Payta, Peru.

Head,  $\frac{1}{2}$  to  $4\frac{1}{2}$  in length to base of caudal; depth,  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; eye,  $3\frac{1}{2}$  in head; interorbital space,  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; snout,  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; maxillary,  $2\frac{1}{2}$ ; height of front of dorsal, 1 to  $1\frac{1}{2}$ ; front of anal,  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; pectoral,  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; ventral,  $1\frac{1}{2}$ ; caudal,  $\frac{1}{2}$  to 1. Dorsal, 10 or 11; anal, 28 to 30; scales, 36 to 39; transverse series, 7+1+7.

Ventral outline of body forming a deeper curve than dorsal outline. Nape straight or sometimes very slightly concave. Maxillary extending past front of eye nearly to front of pupil. Gill rakers short and rather slender; the longest one-third of diameter of eye; 10 or 11 on lower limb of arch.

Front of dorsal midway between base of caudal and tip of snout, or varying from this point to a point midway between base of caudal and anterior margin of eye. Origin of anal under base of sixth or seventh dorsal ray. Ventrals placed considerably in front of dorsal; their tips not reaching to front of anal. Pectoral scarcely reaching to base of ventral.

A dark lateral band runs from upper part of gill opening to base of middle caudal rays, becoming broad behind middle of body, constricted on caudal peduncle, again expanding to a large dark spot at base of caudal, and continued to tips of median caudal rays. Anteriorly an indefinite spot, slightly lighter than the ground color, more or less completely separates a small portion of the lateral band from the main part. Specimens from Eten do not have the lateral band so much expanded just behind middle of body and not so dark or conspicuous anteriorly as those from Payta.

<sup>a</sup>Cat. Fish Brit. Mus., V., p. 307.

## 24. TETRAGONOPTERUS FESTÆ Boulenger.

A dozen specimens collected at Mirador, Ecuador, the longest the same length as Boulenger's type, 65 mm. These differ from the original description in having a smaller eye as compared with the snout and head, a smaller average number of scales, and the lateral spots always conspicuous. Mr. C. Tate Regan has kindly compared one of these specimens with the typical specimens in the British Museum and has pronounced them to be identical.

Head, 4 to  $4\frac{1}{2}$  in length to base of caudal; depth,  $2\frac{1}{2}$  to 3. Eye, 3 to  $3\frac{1}{2}$  in head; snout, 4 to  $4\frac{1}{2}$ ; height of dorsal 1; height of front of anal,  $1\frac{1}{2}$ ; pectoral, 1 $\frac{1}{2}$ . Dorsal, 10 or 11; anal, 34 or 35. Scales, 41 to 44; 8 series above lateral line and 8 or 9 below.

Body compressed and rather deep, somewhat angulated in front of dorsal; ventral outline forming a more even curve than that of dorsal; only the larger specimens concave at nape. Breast transversely rounded in front of ventrals. Snout blunt; jaws equal, or the lower a little shorter. Teeth rather large, 4 on each side of lower jaw. Maxillary smooth on its anterior edge; scarcely reaching to anterior border of eye, but extending down nearly to opposite lower border or eye. Gill rakers slender; the longest one-third of eye; 10 to 12 on lower part of arch.

Origin of dorsal midway between base of caudal and anterior border of eye. Tip of dorsal when depressed reaching to a point midway between base of last dorsal ray and base of auxilliary caudal rays. Front of anal under middle of dorsal; last anal ray extending a little past adipose dorsal. Posterior outline of anal shallowly concave. Pectoral reaching past base of ventral a distance equal to three-fourths diameter of eye. Ventrals barely reaching front of anal.

Color dusky above, darker on top of head, sides and lower parts pale. A dark lateral band running from upper part of gill opening to base of median caudal rays, where it terminates in an expanded darker blotch, with sometimes a second, smaller, less conspicuous, blotch behind it on base of median caudal rays. The lateral band grows darker posteriorly and is bordered below by a very fine dark line. Traces remain of a narrow silvery lateral band directly below the dark band. Crossing the lateral band anteriorly are 2 large, conspicuous, elliptical, or sometimes crescent-shaped spots, extending obliquely downward and forward; the posterior one above the tip of the pectoral, the other a little posterior to the base of the pectoral. A few pigment dots on posterior parts of dorsal, anal, and caudal; fins otherwise colorless.

In the original description the eye is said to be twice the length of the snout, and contained  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in the head. The scales in the lateral line number from 44 to 47. The color as follows: Une

bande argentée le long du corps, se terminant en une tache noire sur la queue, à la base de la caudale; en avant, sur la ligne latérale, deux taches noires plus ou moins nettes; ces taches manquent parfois.

25. **TETRAGONOPTERUS RUTILUS** Jenyns.

A single specimen, 165 mm. in length, collected in the Rio Perené, on the east slope of the Andes in Peru, appears to be referable to this species. It differs from *T. peruanus* in having the dorsal more anteriorly placed. The front of the dorsal is midway between the tip of the snout and a distance behind the tip of the adipose dorsal equal to a diameter of the pupil. The anal is one diameter of the eye behind the base of the last dorsal ray, or nearly under the tip of the last dorsal ray. The ventrals are two-thirds of a diameter of the eye in front of the dorsal.

26. **BRYCON ATRICAUDATUS** Kner.

Several specimens were taken at Payta and one at Eten, Peru. The longest 15 cm. in length.

Head,  $3\frac{1}{2}$  in length without caudal; depth  $3\frac{1}{4}$ . Eye,  $4\frac{1}{2}$  in head; maxillary,  $2\frac{1}{2}$ ; snout,  $3\frac{3}{4}$ ; interorbital space, 4. Dorsal, 10 or 11; anal, 28 or 29. Scales, 54 to 56; transverse series,  $10+1+6$ .

Lower jaw included; maxillary reaching to below middle of eye. Gill rakers slender, the longest two-fifths of diameter of eye; 15 on lower limb of arch. Origin of dorsal midway between nostril and base of caudal; one diameter of eye behind base of ventrals. Anal one-half of diameter of eye behind base of dorsal. Pectoral not quite reaching to base of ventral, which does not reach to front of anal. Caudal deeply forked.

A dark, usually very definite humeral spot crosses the anterior end of lateral line, the greater part of its area above the line. An inconspicuous blotch at base of caudal.

Family STERNOPYGIDÆ.

27. **STERNOPYGUS ÆQUILABIATUS** (Humboldt).

Several specimens collected at Guayaquil, the largest 53 cm. in length.

Depth of body, five-sixths to seven-eighths of length of head to upper end of gill opening. Snout, contained 3 times in head; maxillary, 4 to  $4\frac{1}{2}$  times. Eye (between adipose eyelids),  $5\frac{1}{2}$  to 6 times in snout, 16 to 18 in length of head. Length of gill opening less than length of snout by 1 diameter of eye. Fine movable teeth with their tips only slightly projecting beyond the spongy dermal tissue are set in broad bands on jaws; the upper band nearly straight and broadly rounded at its ends; one-third as broad as long; the lower band crescent-

shaped, tapering to a point at its ends, and a little longer than upper band, though scarcely so broad.

Head and body dark with small, round punctulations. A pale-band beginning at a point midway between base of anal fin and lateral line, a little anterior to middle of body, follows the ventral outline of body to tip of tail; posteriorly it curves up and runs along the lower edge of lateral line.

#### Family OPHICHTHYIDÆ.

##### 28. OPHICHTHUS CALLAENSIS (Günther).

A specimen from Guayaquil is probably referable to this species though differing somewhat from the original description. The gape is contained  $2\frac{1}{4}$  times in the head; the head is less than half the length of the trunk; and the tail is  $1\frac{1}{4}$  times the rest of the body.

The type is described as having the gape one-third the length of the head; the head more than half the length of the trunk; and the tail  $1\frac{1}{4}$  times the rest of the body.

Jordan and Davis<sup>a</sup> report on specimens having the head as compared with the trunk similar to the specimen at hand.

#### Family ELOPIDÆ.

##### 29. ELOPS SAURUS (Linnaeus).

Our specimen from Guayaquil.

#### Family CLUPEIDÆ.

##### 30. POTAMALOSA NOTACANTHOIDES (Steindachner).

Specimens taken at Callao, Peru.

##### 31. SARDINELLA FIMBRIATA (Kner and Steindachner).

Specimens from Callao, Peru, agree very well with the original description. The dorsal is slightly in front of the middle of the length of the body to the base of the caudal; and the pectoral is from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  times in the head, not 2 times as originally described.

##### 32. ILISHA FURTHI (Steindachner).

Four specimens collected at Guayaquil, Ecuador, from 22 to 24 cm. in length. These do not differ from specimens from Panama except that the depth is contained 3 times in the length to base of caudal. Panama specimens of this length are deeper, while those of this depth are larger.

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<sup>a</sup> Report U. S. Fish Commission, 1888, p. 634.

## Family POECHLIIDÆ.

33. *ORESTIAS PENTLANDI* Valenciennes.

This species is the best represented of its genus in the collection. Sixteen specimens, from 18 to 20 cm. in length, were collected at Lake Titicaca.

*O. pentlandi* is an elongate form like *O. curieri*, but may be known at sight by the short head, the small mouth and eye, the more complete and smoother squamation of the anterior part of the body, and the slender caudal peduncle. The form of the head and body is more symmetrical than in any *Orestias* here represented. The back is not elevated to a blunt ridge; the temporal region is not laterally produced, and the anterior dorsal outline forms an unbroken curve to the tip of the snout.

Head  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in length to base of caudal. Gape of mouth from symphysis of premaxillaries to lower angle of mouth equal to diameter of eye; width of mouth between lower angles  $1\frac{1}{2}$  to  $1\frac{1}{2}$  times the diameter of eye. Interorbital space evenly arched; 2 to  $2\frac{1}{2}$  times the diameter of eye.

Series of scales above middle of sides from 55 to 60; 16 or 17 rows between front of anal and front of dorsal. Side scaled to a level with lower pectoral ray or a little below. Area in front of pectoral usually naked, but sometimes with a few scales. Top of head back to behind eyes naked in some specimens, entirely scaled to slightly in front of eyes in others, or with a few scattered scales in still others. A narrow suborbital region always naked; scales of cheek extending forward in varying degrees.

Caudal peduncle narrow and less compressed than in any other *Orestias* in the collection, though there is a large individual variation in this respect. Width of caudal peduncle from 2 to 3 times in length of head.

34. *ORESTIAS CUVIERI* Valenciennes.

Four specimens from 22 to 24 cm. in length from Lake Titicaca.

This species has a larger more oblique mouth, larger teeth, and a longer head in proportion to the depth of the head, than any other species of *Orestias* here considered.

Depth of head at occiput  $1\frac{1}{2}$  to 2 in length of head. Length of gape from symphysis of premaxillaries to lower angle of mouth  $\frac{1}{2}$  to  $\frac{1}{2}$  times greater than diameter of eye, and equal to width of mouth across its lower angles. Eye contained  $1\frac{1}{2}$  to  $1\frac{1}{2}$  times in distance from its anterior edge to mouth, or 2 times obliquely across top of snout to union of premaxillaries, and  $1\frac{1}{2}$  times in interorbital space.

Ventral surface naked below a line extending obliquely downward and backward from upper angle of gill opening to base of last anal ray, or sometimes to lower caudal rays, leaving a narrow naked area

on lower side of caudal peduncle. A more or less continuous row of scales runs along the medium line of back, on each side of which is a naked area with or without scales scattered sparsely over it. Naked area may be continued over top of head, interrupted only by a few scales at occipital region, or top of head may be wholly covered with rough scales to opposite front of eyes. Side of head wholly naked except where scales irregularly cover upper half of opercle and small area on cheek behind eye. Region in front of pectoral naked.

35. *ORESTIAS AGASSIZII* Valenciennes.

Four specimens, from 150 to 165 mm. in length, were collected in Lake Titicaca at Chililaya, Bolivia.

This species, in proportions of body, stands about midway between the elongate *O. pentlandi* and *O. curvieri* and the short *O. albus* and *O. luteus*.

I have little to add to the description published by Garman.<sup>a</sup> Mouth very small; gape from symphysis of premaxillaries to lower angle of mouth equal to long diameter of orbit; width of snout between lower angles of mouth from  $1\frac{1}{2}$  to  $1\frac{1}{2}$  times diameter of orbit. The picture published by Cuvier and Valenciennes shows an area in front of pectoral covered with scales. In three of our four specimens this area is entirely naked; in the other 2 or 3 scales remain and depressions indicate the former presence of other scales. It is probable that these scales are lost in the adult fish, as are those on top of snout. The head is contained 4 times in the length to base of caudal, not  $4\frac{1}{2}$  as in Garman's specimens.

36. *ORESTIAS ALBUS* Valenciennes.

Six specimens from 148 to 155 mm. in length collected in Lake Titicaca.

This species (at least of the size at hand) may be at once known by the naked area on the upper part of the side, in connection with the short body.

Length of head, without projecting mandible,  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in length to base of caudal. Depth of head at occiput  $1\frac{1}{2}$  in length of head, and equal to width of head at opercles, or sometimes a very little less than width of head. Diameter of eye equal to its distance from mouth;  $1\frac{1}{2}$  in snout measured obliquely over top of snout to union of premaxillaries; contained  $1\frac{1}{2}$  to  $1\frac{1}{2}$  times in interorbital space.

Mouth vertical; lower end of gape below level of eye. A considerable amount of variation is exhibited in the squamation. Usually there is a continuous single row of rough plates from the occiput to the dorsal, with a large naked area at each side of it. In some specimens, however, the dorsal plates are absent anteriorly and the lateral

<sup>a</sup> Mem. Mus. Comp. Zool., XIX, No. 1, 1895, p. 150.

naked areas are not separated from each other in this region. In one or two examples a few scales or plates are irregularly scattered over the lateral naked areas. Usually the naked areas extend back nearly to opposite front of dorsal, but in some cases it does not extend more than half that distance, and in others it is continued back along the whole base of dorsal. Usually the side is scaled to a level of the lower pectoral ray, but sometimes the scales are absent below a line curved downward between the base of the upper pectoral ray and the front of anal. A triangular area of scales on cheek sometimes reaches forward to below front of eye and sometimes ceases below middle of eye; in either case the preorbital region may be entirely naked or with a few scattered plates. A few of the specimens show traces of scattered plates on the ventral surface, probably indicating their presence on smaller specimens. The region in front of pectoral is naked and nearly covered by the opercle.

37. *ORESTIAS LUTEUS* Valenciennes.

This species is represented by 6 specimens, from 122 to 142 mm. in length, taken in Lake Titicaca at Chililaya, Bolivia. It is at once known by the wide short head, having strong lateral angles.

*O. luteus* has a much shorter head than *O. albus*; head 3 to  $3\frac{1}{4}$  times in length of body to base of caudal. The height of head is greater, though contained about the same number of times in the shorter head. Width of head nearly equal to length of head. The back is much more elevated than in *O. albus*, and there is a strong concave region at each side of back. The elevation of back makes the dorsal outline of head and nape more or less concave. Head as viewed from above much produced laterally at the temporal region, forming broadly rounded angles which taper quickly to the narrow scarcely produced snout. Mouth smaller than in *O. albus*; not quite vertical; lower end of gape scarcely extending below lower margin of eye. Scales more regularly placed and no naked area present on side of back; scales covering side more completely below; naked area of belly not reaching to level of lower pectoral ray. Opercle not extending so far over region in front of pectoral, which region is nearly always thickly covered with rough scales, though in one specimen it is naked.

Family TYLOSURIDÆ.

38. *TYLOSURUS JORDANI*, new species.

Head,  $2\frac{1}{2}$  in length from tip of upper jaw to base of caudal. Depth at occiput, twice diameter of eye. Eye,  $3\frac{1}{4}$  in postorbital part of head; interorbital space,  $2\frac{1}{4}$  in same space. Eye and postorbital part of head contained  $1\frac{1}{2}$  times in mandible, measuring from eye. Dorsal, 13; anal, 14. Scales, 240.

Body as broad as deep; caudal peduncle very slightly compressed, but appearing perfectly round; no caudal keel. Interorbital space slightly wider than eye, and flatter than in *T. scapularis*. The longitudinal channel little evident, and behind eye scarcely sunk below general level of top of head. In the latter species (two specimens from Panama) the top of head bears a deep groove which extends back nearly to opposite middle of cheek, where it terminates rather abruptly. Scales on cheek much smaller than in *T. scapularis* as shown in accompanying figures; in 21 or 22 irregular rows counting longitudinally, and appearing scarcely more than half as large as in the latter species, which has about 15 irregular rows on cheek.

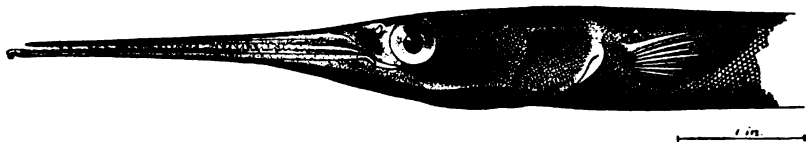


FIG. 6.—*TYLOSURUS JORDANI*.

Pectoral contained 14 in. postorbital part of head. Ventrals inserted one diameter of eye nearer base of caudal than posterior margin of eye. Front of dorsal over base of fifth anal ray; tip of last anal ray reaching to below base of next to last dorsal ray. Caudal slightly lunate; the lobes rounded; lower lobe considerably longer than upper.

Color as in *T. scapularis*, but everywhere darker. Under parts little lighter than sides and back. Fins all dusky; a dark scapular spot present. No trace remains of a silvery lateral band, but occupying the same region is a dark bluish band that is very indefinite. The specimen was preserved in formalin and if it had any silvery color it was destroyed.

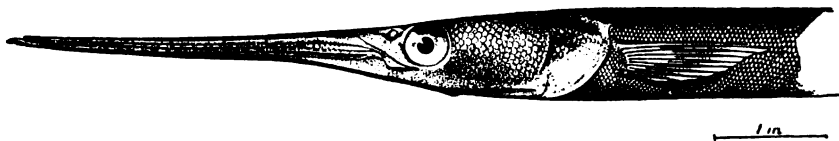


FIG. 7.—*TYLOSURUS SCAPULARIS*.

This species is close to *T. scapularis* Jordan and Gilbert, but differs in having smaller scales, particularly those on cheek, and scarcely any interorbital groove. From *T. fluviatilis* (Regan) it differs in having fewer fin rays, more posterior insertion of the ventrals, and the interorbital space greater than the length of the eye. *T. fluviatilis* has 15 or 16 dorsal rays and 17 or 18 anal rays.

The type and sole specimen is 37 cm. in length and was collected at Guayaquil, Ecuador. It is deposited in the U. S. National Museum, Cat. No. 53469.

I take pleasure in naming this species for Dr. David Starr Jordan, whose advice first made my study of ichthyology feasible.

## Family SYNGNATHIDÆ.

## 39. SYNGNATHUS STARKSI (Jordan and Culver).

A specimen from the river at Santa Rosa, Ecuador, differs from the typical specimens only in having the snout strongly curved up and the dorsal situated about half a body ring more posteriorly. The number of rings and fin rays are the same.

## Family ATHERINIDÆ.

## 40. KIRTLANDIA PACHYLEPIS (Günther).

A single small specimen from Guayaquil, Ecuador.

## 41. BASILICHTHYS REGILLUS Abbott.

Several specimens collected at Callao, the type locality of the species. They agree in all essential respects with the typical specimens, with which they have been compared. In the original description the statement "origin of first dorsal nearer snout than base of caudal by one-third length of head," should read, nearer base of caudal than snout by one-third length of head.

## Family MUGILIDÆ.

## 42. MUGIL CUREMA Cuvier and Valenciennes.

Two specimens taken at Guayaquil, Ecuador.

## 43. MUGIL HOSPES Jordan and Culver.

A specimen from Guayaquil, Ecuador, agrees in all characters with specimens from Panama, and with the typical specimens from Mazatlan. Like them it has in the mouth the parasitic crustacean.

## Family POLYNEMIDÆ.

## 44. POLYDACTYLUS APPROXIMANS (Lay and Bennett).

One moderate-sized specimen from Guayaquil. It and a specimen from Callao, Peru, that is in the Stanford University collections, have 15 anal rays rather than 13 or 14, as in all of the specimens examined from Panama and Mexico. It is much darker than the northern specimens, but differs in no other respect.

## Family SCOMBRIDÆ.

## 45. SCOMBER JAPONICUS Houttuyn.

Specimens from Callao, Peru.

46. *SARDA CHILENSIS* (Cuvier and Valenciennes).

One specimen from Callao, Peru.

## Family CARANGIDÆ.

47. *OLIGOPLITES MUNDUS* Jordan and Starks.

Two specimens collected at Guayaquil. One of them has but 16 anal rays, though in other respects it differs in no way from specimens from Panama and Mexico. The usual number of anal rays is 19 or 20; one specimen from Panama has 18.

Mr. C. Tate Regan, comparing specimens of *O. saliens* with a specimen of *O. mundus*, reports them to be identical. His specimen of *O. mundus* can not be correctly identified, as these two species differ greatly. The maxillary of *O. mundus* is 17 or 18 hundredths of the length without caudal. In Bloch's figure of the type of *O. saliens* the maxillary is only 12 hundredths, and a specimen of what is apparently *O. saliens* from Brazil, in the Stanford University collections, has a maxillary 14 hundredths. *O. mundus* has the head from 25 to 26½ hundredths of the length, and the depth from 34 to 36 hundredths. Bloch's figure shows *O. saliens* to have the head 22 and the depth 29 hundredths, which agrees exactly with our Brazilian specimen of that species.

Mr. Regan's Pacific specimen may be *O. altus* Günther, as apparently that species is very close to, if not identical with, *O. saliens*.

48. *NEPTOMENUS CRASSUS*, new species.

Head, 3 to 3½ in length to base of caudal (3½ to 4 including caudal); depth, 3½ (4½). Eye, 5 to 5½ in head; snout, 3½ to 4; maxillary, 3½; interorbital space, 3 to 3½. Dorsal, VII, I, 27; anal, II, 21; scales, 90 above lateral line; 97 in lateral line.

Ventral outline of body more deeply curved than dorsal; head rather wide and blunt. Snout as viewed from above wide and broadly rounded in front; its width in front of eyes a little greater than its length. Jaws equal; mouth rather oblique. Anterior end of maxillary slightly below a level with middle of eye; posterior end reaching to below front of eye or very slightly past. Maxillary not protractile; the skin continuous from upper lip to top of snout. Teeth very fine, in a single even row on jaws; the lower row shutting inside of the upper "like a box-lid," as described for the related genus *Cubiceps*. No teeth on vomer or palatines. Interorbital space broad and evenly convex. Top of head and snout of a rubber-like consistency and thickly set with small pores. Eye considerably above the middle of the height of the head (nearly in the middle in *N. brama*); a line drawn through the middle of the head longitudinally passes slightly

above the lower edge of the eye. Narrowest part of preorbital including eyelid one-half of diameter of pupil; the bone only one-fourth of pupil. Posterior edge of preopercle concave; the lower edge and the angle broadly rounded. Gill rakers moderately slender; the longest scarcely one-half the diameter of eye; 15 of them on lower part of arch.

Scales cycloid and regularly arranged; those of lateral line scarcely enlarged but raised to a slight ridge, especially on caudal peduncle. Thin scales present on cheeks and opercles; the rest of head naked.

Spinous dorsal low; closing into a groove; the longest spine not exceeding diameter of eye in length. Soft dorsal and anal highest in front; the longest rays equal to length of snout. Anal spines very small and not separated from the soft rays; the first spine directly under middle of soft dorsal. Soft dorsal and anal coterminous; the distance from base of dorsal to upper caudal rays  $1\frac{1}{2}$  times the diameter of eye. Pectoral reaching to above front of anal; its length a little

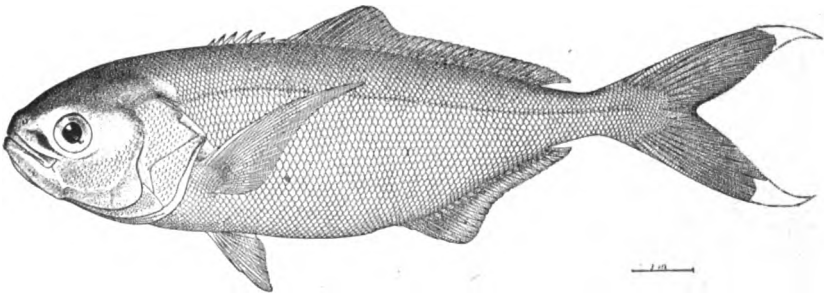


FIG. 8.—NEPTOMENUS CRASSUS.

less than that of head. Ventrals adnate to the belly; their tips reaching halfway from their base to the middle of vent. Caudal deeply forked.

Color, dusky above; black on top of head; sides and lower parts silvery. Sides of head, and particularly mandible, set with small points of dark brown. Vertical fins dusky; the dorsals darker than anal; pectoral slightly dusky; darker on inner surface; axil dark brown.

This species agrees with *N. brama* in number of fin rays and scales, but if current descriptions of the latter are dependable it is a more slender species, with a larger head, and with the eye above the middle of the height of the head.

Günther describes the type as having the depth  $3\frac{1}{2}$  in the total length, and the head  $4\frac{1}{2}$ . He evidently includes the caudal in his measurements, as his specimen was  $14\frac{1}{2}$  inches in total length and  $4\frac{1}{2}$  inches deep.

The type, however, was a stuffed specimen, and these measurements could not be depended upon did not a description by Hutton (presumably from fresh or alcoholic specimens) agree very well on these points

with the description of the type: Depth,  $2\frac{3}{4}$  in length, without caudal; head,  $3\frac{1}{4}$ .

This is apparently the first record of the occurrence of this genus outside of Australian seas.

Two specimens of about the same length were taken at Callao, Peru. The type is 34 cm. in length, and is deposited in the U. S. National Museum, Cat. No. 53465. The cotype is in Stanford University museum.

49. **CARANX HIPPOS** (Linnæus)

A specimen from Guayaquil.

50. **VOMER SETIPINNIS** (Mitchill).

One specimen from Callao.

51. **SELENE VOMER** (Linnæus).

Two specimens from Guayaquil.

52. **TRACHINOTUS KENNEDYI** Steindachner.

Two specimens from Guayaquil differ from specimens from Panama only in color. The body is black above and dark on sides with small punctulations. The lobe of the dorsal is black and the other fins are very dark, except the ventrals, which are dusky. The maxillary and side of the head are dark. Panama specimens are bright silvery, and slightly dusky above. The dorsal is dusky and the other fins very slightly dusky except the ventrals, which are white. The side of the head and maxillary are silvery.

53. **TRACHINOTUS PALOMA** Jordan and Starks.

A specimen from Callao, 267 mm. in length without caudal, has a smaller eye ( $6\frac{1}{2}$  in head) than a specimen from Panama, but is not otherwise essentially different.

In comparing this species with *T. carolina*, specimens of nearly the same size should be selected. In the original description of this species the head was alleged to be larger than in *T. carolina*. Gilbert and Starks in comparing specimens of about the same size found no difference in this respect, though the species was found to be well distinguished by other characters.<sup>a</sup> In comparing the specimen at hand with a large specimen of *T. carolina*, 345 mm. in length without caudal, the head is shorter, being  $4\frac{1}{8}$  in length in *T. paloma*, and  $3\frac{3}{8}$  in *T. carolina*.

Family CENTROPOMIDÆ.

54. **OXYLABRAX ARMATUS** (Gill).

Three small specimens from Guayaquil.

<sup>a</sup>Mem. Cal. Acad. of Sci., IV, 1904, p. 84.

## Family SERRANIDÆ.

55. *PARALABRAX HUMERALIS* (Cuvier and Valenciennes).

Numerous specimens were collected at Callao, Peru, from 10 to 35 cm. in length. The young of 10 or 12 cm. in length have 7 cross bars, composed of small dark-brown spots scattered over a dusky ground color. These are regular in form and position on lower half of sides, but on middle of sides a longitudinal band more or less interrupts them, and their upper ends are more indefinite and do not always coincide in position with their lower ends. A dusky band runs downward from eye obliquely across cheek. The soft dorsal, anal, and caudal have round brown spots scattered over them. On specimens 15 cm. in length all of these markings are indistinct, and on large specimens they are altogether lost. A white spot is usually present on the back, between the lateral line and base of dorsal, opposite the notch between dorsals, both in young and adult examples.

56. *PARALABRAX CALLAENSIS*, new species.

Plate LXV, fig. 2.

Head,  $2\frac{1}{2}$  in length to base of caudal; depth,  $3\frac{1}{4}$ . Eye,  $5\frac{1}{4}$  in head; maxillary,  $2\frac{3}{4}$ ; snout,  $3\frac{3}{4}$ ; interorbital space (bone),  $5\frac{1}{4}$ . Dorsal, X, 14; anal, III, 7. Scales in  $8\frac{1}{4}$  series above lateral line; pores in lateral line, 67; 15 scales in a series running downward and backward from front of dorsal to lateral line;  $3\frac{1}{4}$  in a series running upward and backward from front of anal to lateral line.

Lower jaw strongly projecting. Some of the teeth in jaws slightly enlarged and recurved, but not canine-like. Maxillary reaching a little past middle of eye, scarcely to posterior edge of pupil. Widest part of maxillary three-fifths of diameter of eye. Edge of preopercle close-set with small, sharp, even, spinules scarcely enlarged at the angle. The bony part of interorbital space flat. Gill rakers slender, the longest three-fifths of diameter of eye;  $12+21$  in number. Top of head bearing scales anteriorly to nostrils. Snout, preorbital, maxillary, and mandible naked.

Third dorsal spine longest; from its tip to tip of seventh spine the outline of fin is somewhat concave. The first spine is half the length of the second, and the second is contained  $2\frac{1}{4}$  times in the third; the third spine is half the length of head; the last 3 spines subequal in length and contained 4 times in head. Pectoral broad, truncate at tip, and broadly rounded below; its length  $1\frac{1}{4}$  in head; reaching past tips of ventrals, but not to vent. Second and third anal spines subequal in length; the third reaching a little past tip of second when fin is reclined. Anal rays much higher than those of soft dorsal; tips of

last rays not reaching so far back as those of soft dorsal. Caudal fin shallowly lunate.

Back and sides with wavy dark brown spots nearly as wide as pupil, running irregularly horizontal or sometimes slightly oblique. These are but little broken up on sides, but on base of caudal and on back below anterior part of spinous dorsal they break up into round spots separated by narrow interspaces. Lower part of head with stripes similar to those on body, but clearer cut at the edges. Lateral line running in a light streak much broken up by the wavy streaks crossing it. A white spot on back between lateral line and base of dorsal opposite the dorsal notch as in *Paralabrax humeralis* and *Paralabrax albonotatus*. Upper parts of head dark brown; a few indistinct small round lighter spots on snout and preorbital region. Lower parts of head and body dusky. Spinous dorsal slightly dusky; a dark bar behind third spine, and a fainter one behind fourth. Soft dorsal mottled with dark brown. Anal and ventrals dusky, darker toward tips of rays. A dark spot in front of base of pectoral, separated from a crescentic bar of dark brown on base of pectoral rays by a narrow light bar.

The general pattern of coloration resembles very much that of *Mycteroperca boulengeri*, and serves at once to distinguish this species from others of its genus.

The type and sole specimen is 247 mm. in entire length, and was taken at Callao, Peru. It is deposited in the U. S. National Museum, Cat. No. 53471.

#### Family LUTIANIDÆ.

##### 57. LUTIANUS ARGENTIVENTRIS (Peters).

Three specimens from Guayaquil, Ecuador.

#### Family HÆMULIDÆ.

##### 58. ANISOTREMUS PACIFICI (Günther).

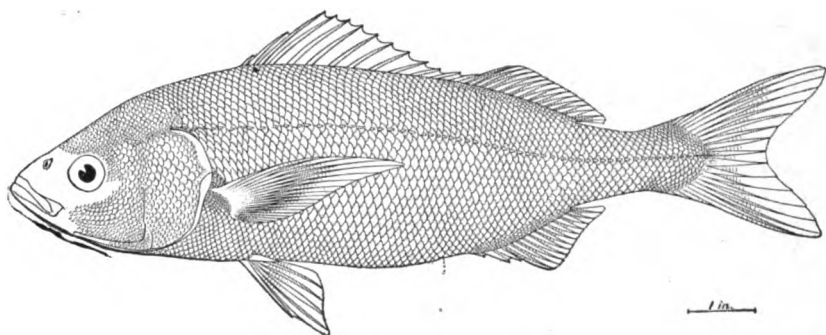
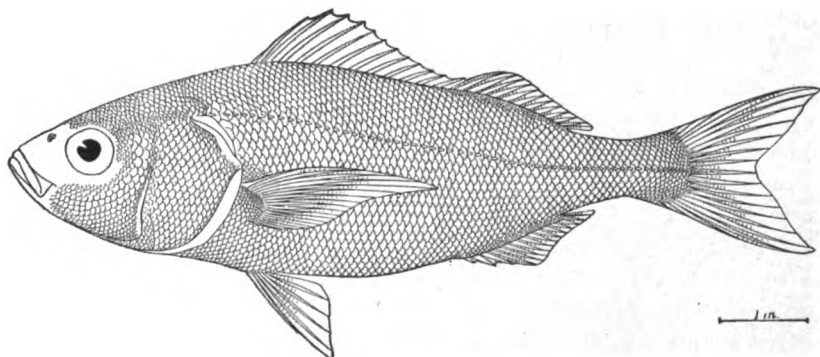
One specimen from Guayaquil, Ecuador, does not differ from specimens from Panama.

##### 59. ANISOTREMUS SCAPULARIS (Tschudi).

Three small specimens taken at Callao, Peru. A specimen 40 cm in length, in the Stanford University collections, retains the black axillary spot and the spots at the last dorsal and anal rays. The preopercle is no less sharply denticulated than in small specimens. Specimens from the Galapagos Islands and Cocos Island are darker in color, and have lost the posterior dorsal and anal spots.

60. *ISACIA CONCEPTIONIS* Cuvier and Valenciennes.

Two specimens from Callao, Peru, in length 233 and 290 mm. respectively. The head is contained in entire length to base of caudal  $3\frac{1}{4}$  times. The eye in head  $5\frac{1}{4}$  to  $5\frac{1}{2}$  times. The vertical limb of the preopercle is straight, or but little concave. The mandible is a little thicker toward the tip than in *I. venusta*, and projects slightly more. This character is somewhat more marked in the larger specimens (here drawn) than in the other. The specimens at hand are everywhere darker than in *I. venusta*, being black above and very dark on sides.

FIG. 9.—*ISACIA CONCEPTIONIS*.FIG. 10.—*ISACIA VENUSTA*.61. *ISACIA VENUSTA*, new species.

*Isacia conceptionis* ABBOTT, Proc. Acad. of Sci. Phil., 1899, p. 350, Callao, Peru.

Head,  $2\frac{3}{4}$  to  $3\frac{1}{10}$  in length to base of caudal; depth  $3\frac{1}{4}$  to  $3\frac{1}{2}$ . Eye,  $4\frac{1}{4}$  to  $4\frac{1}{2}$  in head; interorbital space,  $3\frac{3}{8}$  to 4; snout,  $3\frac{3}{8}$  to 4; maxillary,  $3\frac{3}{8}$  to 4. Dorsal, XIII, 13 or 14; anal, III, 13. Scales, 52 to 54.

Profile of head and body with the curves moderate and unbroken; the ventral and dorsal outlines similar. Jaws equal, or the lower very slightly projecting when mouth is closed. Maxillary scarcely reaching to below front of eye. Teeth in rather broad villiform bands,

which grow narrower on sides of jaws; the outer row of teeth a little enlarged; no teeth on vomer or palatines. Interorbital space evenly curved from eyes and unbroken by ridges. Vertical limb of preopercle concave; the edges with small weak spines partly hidden by the skin, and not enlarged at the angle. The longest gill rakers nearly half as long as eye; 22 or 23 of them on the anterior limb of arch.

Scales ctenoid; snout, mandible, maxillary, and the greater part of preorbital naked. Dorsal and anal naked; a very slight scaly sheath at the base of each; that of anal a little the better developed. Ventrals, pectorals, and caudal with a few scales on base; fine scales running nearly to the tips of caudal rays.

Pectoral  $1\frac{1}{6}$  to  $1\frac{1}{4}$  in the length of head; reaching to a point midway between tips of ventrals and front of anal. Third and fourth dorsal spines equal and the highest; their length  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head; behind these the spines gradually and uniformly decrease in length to the soft dorsal. Base of soft dorsal from  $1\frac{1}{4}$  to 2 in head. The anterior or longest rays of soft dorsal equal in length to those of anal and a little greater than the diameter of eye. The anal ends slightly in front of the soft dorsal. Ventrals reaching halfway from their base to front of anal. Caudal forked; the upper lobe a little longer than lower.

Color greenish gray on back; sides and belly silvery, overlaid with dusky shades. The scales on sides have a darker border, and faint traces of longitudinal streaks follow the rows of scales. Base of pectoral with a dark spot above on both sides of fin; axil dusky; inner surface of fin usually darker than outer surface. Ventrals dark, and growing darker toward their tips. Dorsals dusky; the spinous dorsal sometimes black; the rays of soft dorsal and anal similar, growing darker toward tips.

This species differs from *Isacia conceptionis* in having a larger eye, a longer head, the lower jaw a little thinner at the tip and slightly less projecting, and the vertical limb of the preopercle more concave. The color is everywhere lighter in the specimens at hand, though the markings are the same.

In the description given by Abbott (quoted above) the measurement given for the length of the head is incorrect. It is  $2\frac{1}{6}$  in entire length to base of caudal in his smaller specimen and  $3\frac{1}{6}$  in his larger one. Cuvier and Valenciennes say that the length of the head of *Isacia conceptionis* is less than the depth. It is constantly greater than the depth in *Isacia venusta*, and slightly less, or equal to the depth in our specimens of the former species.

Four specimens collected at Callao, Peru. Besides these there are in the Stanford University collections two specimens from the same locality collected by Admiral Beardslee. The specimens range from 175 to 250 mm. in length. A specimen 220 mm., collected by Mr. Simons, is selected as the type. It is Cat. No. 53467, in the U. S. National Museum. Other specimens are in Stanford University museum.

## 62. POMADASIS BURRO, new species.

Plate LXV, fig. 3.

Head,  $2\frac{3}{8}$  to  $2\frac{1}{2}$  in length to base of caudal; depth,  $2\frac{3}{8}$ . Eye, 5 to  $5\frac{1}{2}$  in head; snout,  $2\frac{1}{4}$ ; maxillary,  $3\frac{1}{8}$  to  $3\frac{1}{2}$ ; interorbital space,  $4\frac{1}{8}$ ; fourth dorsal spine, 3 to  $3\frac{1}{4}$ ; second anal spine,  $2\frac{1}{4}$ . Dorsal, XI, 1, 13; anal, III, 8. Scales, 47.

Upper anterior profile concave above eyes; that of snout straight and long. Edge of preopercle without trace of serrations; opercle with a broad dermal flap. Maxillary reaching to or slightly behind the vertical from anterior nostril. Lips thick and spongy; lower jaw a little projecting. Gill rakers rather thick, one-fourth of diameter of eye; 15 developed on anterior limb of arch.

Pectoral reaching to opposite vent; ventrals three-fourths or distance from their base to vent. Second anal spine a little shorter than soft rays, near its tip it tapers quickly to a point that is not very acute.

This species has the general characters of *P. macracanthus*, but differs in having no serrations on edge of preopercle, in having shorter dorsal spines, a slightly shorter and much more slender second anal spine, and the head and maxillary longer.

We have numerous specimens of *P. macracanthus* from Mexico and Panama in the Stanford University collections for comparison; the largest equal in size to the larger specimen of *P. burro*. All of them have the preopercle sharply denticulated, the large ones showing no decrease in the size or sharpness of the denticulations.

Two specimens were collected at Guayaquil, 26 and 31 cm. in length. The larger one is the type and is Cat. No. 53468, U. S. National Museum. The cotype is in Stanford University museum.

Burro, the vernacular name in Central and South America of different species of *Pomadasis*. They make a noise when caught resembling the noise made by a "burro" or donkey.

Table of measurements in hundredths of length.

| Species.....                                 | <i>Pomadasis burro</i> . |         | <i>Pomadasis macracanthus</i> . |                  |     |
|--|--------------------------|---------|---------------------------------|------------------|-----|
|  | Guayaquil.               | Panama. | Mazatlan, Mexico.               | Guaymas, Mexico. |     |
| Length in millimeters to base of caudal..... | 215                      | 260     | 214                             | 258              | 222 |
| Length of head in hundredths.....            | 42                       | 41      | 37                              | 37               | 37  |
| Depth of body.....                           | 37                       | 38      | 38                              | 36               | 35  |
| Length of snout.....                         | 14                       | 14      | 12                              | 14               | 14  |
| Diameter of eye.....                         | 8                        | 7       | 7                               | 7                | 7   |
| Interorbital width.....                      | 9                        | 9       | 8                               | 8                | 8   |
| Length of maxillary.....                     | 12                       | 12      | 11                              | 10               | 11  |
| Length of fourth dorsal spine.....           | 15                       | 14      | 17                              | 18               | 17  |
| Length of second anal spine.....             | 16                       | 15      | 18                              | 18               | 17  |
| Length of pectoral.....                      | 29                       | 30      | 33                              | 28               | 29  |
| Length of ventral.....                       | 22                       | 22      | 21                              | 22               | 21  |

## Family GERRIDÆ.

## 63. EUCINOSTOMUS CALIFORNIENSIS (Gill).

Two specimens from Guayaquil, Ecuador.

## 64. GERRES PERUVIANUS Cuvier and Valenciennes.

Several specimens were taken at Guayaquil, differing from specimens from Panama only in being darker in color.

## Family KYPHOSIDÆ.

## 65. DOYDIXODON LÆVIFRONS (Tschudi).

Plate LXVI, fig. 2.

A single specimen from Molendo, Peru, 27 cm. in length.

This species may be known from *D. freminvillei*<sup>a</sup> by the produced anterior rays of the soft dorsal forming an angle, which when depressed reaches to the tip of the last dorsal ray. The fourth ray is the longest and forms the tip of the angle, behind which the posterior margin of the fin is strongly concave.

In *D. freminvillei* (specimens from the Galapagos Islands in the Stanford University collections) the soft dorsal is not angulated; the tip of the fourth ray is opposite the beginning of the last two-fifths or one-third of the base of the fin. The fin is usually rounded and everywhere convex as shown in the accompanying figure, but its margin may sometimes form a sigmoid curve, convex in front and concave behind, and nowhere angulated except at tip of last ray. The latter condition is shown in Valenciennes' plate,<sup>b</sup> and in the largest of our specimens, 45 cm. in length, but the fourth ray is little if any longer than when the fin is everywhere convex. This condition is probably developed with age.

The anterior rays of the anal of *D. lævifrons* are longer than in the other species, making the posterior margin of the fin more oblique.

Perhaps a greater difference than these is shown in the size of the teeth, which in *D. lævifrons* are nearly twice as large as in *D. freminvillei*, and are in fewer rows. In the former species they are in 5 oblique series, on the mandible, running downward and inward toward the symphysis. In *D. freminvillei* they are in 9 oblique series.

The dorsal of our specimen of *D. lævifrons* has 15 rays. Of the 16 specimens of *D. freminvillei* counted, 10 of them have 17 rays, 4 have 18 rays, and 2 have 16 rays. This is opposite to the condition alleged to exist. Tschudi counts 18 rays in the type of *D. lævifrons* from Huacho, Peru, and Valenciennes counts 15 rays in the type of *D.*

<sup>a</sup>Plate LXVI, fig. 1.

<sup>b</sup>Voyage Venus, pl. v.

*freminvillei* from the Galapagos. The plate published by Valenciennes, however, proves our Galapagos specimens to be *D. freminvillei* by the teeth and shape of the dorsal.

### Family SCIÆNIDÆ.

#### 66. ARCHOSCION ANALIS (Jenyns).

A specimen collected at Callao, Peru, the type locality of the species.

#### 67. CYNOSCION ALBUS (Günther).

A small specimen from Guayaquil, agreeing well with Panama specimens.

#### 68. BAIRDIELLA CHRYSOLEUCA (Günther).

Three specimens from Guayaquil differ slightly from specimens from Panama. The anal rays are 7 in one specimen and 8 in the other two (9 in Panama specimens). There is a considerably longer distance between the tips of the anal rays and the base of the caudal in the former specimen, and a slightly longer distance between these points in the other two than in the specimens from Panama. As usual, the Guayaquil specimens are much darker. No other difference is appreciable, however, and these differences will probably be found to fall within the range of variation of the species.

#### 69. BAIRDIELLA ENSIFERA (Jordan and Gilbert).

A couple of specimens from Guayaquil, Ecuador, differ from Panama specimens only in being darker.

#### 70. STELLIFER MINOR (Tschudi).

A single specimen collected at Callao, Peru. The head in this species is far less cavernous than in other members of the genus *Stellifer*.

#### 71. SCIÆNA FASCIATA (Tschudi).

One small specimen 15 cm. in length from Callao, Peru.

Head, 3 in length to base of caudal ( $3\frac{1}{2}$  with caudal); depth,  $2\frac{1}{2}$  ( $3\frac{1}{2}$ ). Eye,  $4\frac{1}{2}$  in head, scarcely shorter than snout; interorbital space,  $3\frac{1}{2}$ ; maxillary,  $3\frac{1}{2}$ . Dorsal, X, I, 25; anal, II, 9. Scales in lateral line, 51.

Body very deep and compressed; the snout blunt and scarcely projecting over the mouth. Maxillary reaching a little past middle of eye. Mouth slightly oblique; lips papillose. Teeth fine, in bands, the outer series only slightly enlarged. Border of preopercle with very small membranous serræ. Gill rakers very small; only 7 developed on lower limb of arch.

Scales exceedingly sharply ctenoid, each with a broad border of sharp, fine corrugations which involves nearly the whole surface of the scale; each corrugation ending in a fine point. Tip of snout and

mandible naked. Lower half of soft dorsal closely covered with fine scales forming a rather thick sheath.

Third dorsal spine the longest, its length  $2\frac{1}{2}$  in head; the succeeding spines decrease rapidly in length, making the fin triangular. Pectoral short,  $1\frac{1}{2}$  in head, scarcely extending to tips of ventrals, which reach two-thirds of distance from their base to front of anal. Second anal spine stout, but not over three-fourths the length of first anal ray; length of second spine 3 in head. Tips of anal rays reach to below base of last dorsal ray. Caudal slightly S-shaped, the upper lobe the longer; tip of lower angle rounded.

Color dark on sides and back; lower parts dirty silvery. A conspicuous, rather narrow, light band runs downward and slightly obliquely backward from between the dorsals nearly to vent. A similar short band runs from middle of soft dorsal, but does not reach to lateral line. The opercle ends in a broad flap, which is coal black much as in some of the centrarchoid fishes. The fins are all black.

72. *SCIÆNA DELICIOSA* (Tschudi).

This is the best represented Sciænoid fish in the collection. Many specimens were collected at Callao, and one at Molendo, Peru.

Head,  $2\frac{1}{4}$  to 3 in length to base of caudal; depth,  $3\frac{1}{4}$  to  $3\frac{3}{4}$ . Eye,  $5\frac{1}{2}$  to 6 in head; interorbital space,  $3\frac{1}{4}$ ; snout,  $3\frac{1}{4}$  to 4; maxillary, 3. Dorsal, IX or X, 1, 22 or 23; anal, II, 10. Scales, 50 (pores).

Upper anterior profile forming an even curve from nape to snout. Snout projecting beyond tip of mandible in a variable degree as in related species, or from  $\frac{1}{2}$  to 1 diameter of pupil. Viewed laterally its profile usually forms a semicircle, but in one or two specimens it is a little angulated at the tip. Gill rakers scarcely as long as diameter of pupil;  $6 + 12$  or 13 in number.

The fourth dorsal spine the highest,  $2\frac{1}{4}$  in head. The last spine of first dorsal is half as long as the spine of the second dorsal, and is attached to it by a membrane. Tip of pectoral reaching 1 diameter of eye past notch between dorsals. Ventrals reaching one-half of distance from their base to front of anal. Tip of anal reaching to below base of last dorsal ray. Caudal lunate.

Color dusky on back, growing silvery on sides. Rather faint, dark lines following the rows of scales; axil dark.

73. *SCIÆNA GILBERTI*, new species.

Plate LXVI, fig. 3.

Head,  $3\frac{3}{8}$ <sup>a</sup> to  $3\frac{1}{2}$  in length to base of caudal; ( $4$  to  $3\frac{1}{2}$  in entire length); depth,  $3\frac{3}{4}$  to  $3\frac{1}{2}$ . Eye,  $9\frac{1}{2}$  to 11 in head; interorbital space.

<sup>a</sup>The measurement appearing first is of the smaller of our two specimens; where only one measurement is given the specimens do not differ.

$3\frac{1}{2}$  to  $3\frac{1}{2}$ ; snout, 4; maxillary,  $2\frac{1}{2}$ . Dorsal, X, I, 24 to X, I, 21; anal, II, 10. Scales, 66; counting subvertical series there are 10 scales from front of dorsal to lateral line, and 13 from front of anal to lateral line.

Anterior profile gently curved a short distance in front of dorsal, thence appearing perfectly straight to near tip of snout, where it again slightly curves downward. Head very broad, with a broad evenly curved interorbital space, 3 to  $3\frac{1}{2}$  times the diameter of eye. Jaws nearly even in small specimen; the lower included in the large one. Small teeth in 2 or 3 irregular rows in upper jaw, with an outer series of much enlarged ones; the length of the latter equal to diameter of anterior nostril. A row of similar enlarged teeth on lower jaw, and an irregular row of smaller teeth outside of them, fitting close against them. No canines present. Maxillary reaching to a little past anterior border of eye. Anterior nostril small and round; the posterior 3 times as long as wide. Gill rakers 3 or 4 + 10; the longest three-fourths diameter of eye. Edge of preopercle with rather sharp denticles somewhat enlarged toward angle.

Pectoral short; equal in length to ventral;  $2\frac{1}{2}$  in head. Third, fourth, and fifth dorsal spines highest, equal to combined length of snout and eye; tip of third reaching to base of eighth when fin is depressed. The membrane of the next to the last spine scarcely reaches to the base of the last spine, which is a trifle longer than the former, and is attached by a membrane to the soft rays. Base of soft dorsal seven-eighths length of head; its highest rays equal to snout and half eye. Anal spines rather weak, but not flexible; the second spine half the length of the first ray, which is scarcely so long as the second ray; tip of longest ray reaching to tip of last ray when fin is depressed, or to under base of last dorsal ray. Caudal lunate, the middle rays 2 in head, the upper rays  $1\frac{1}{2}$  in the smaller specimen. In the larger specimen the caudal is much more deeply lunate, the upper lobe longer and sharper than the lower; extending  $1\frac{1}{2}$  times diameter of eye past middle rays. Scales ctenoid; the entire head, except the tip of mandible, and lips covered with irregular scales. Dorsal and anal fins naked except a narrow definite area at extreme base. Pectoral with a few scales on base. Caudal with small scales on membrane extending considerably over half the distance from base to tips of rays; a series of small scales carrying lateral line to edge of caudal.

Color dusky on top of head and back, becoming silvery below. Dark lines follow the rows of scales on back and sides. These are scarcely noticeable on the smaller specimen, and not very conspicuous on the larger. Dorsals dusky; caudal and pectoral slightly dusky; anal with a very little dusky color on membrane; ventrals white; inside of opercle dusky.

This species differs from *S. wieneri* Sauvage in having the length of head greater than the depth, and longer as compared with the entire length; the snout shorter as compared with the interorbital space; the eye smaller; the caudal lunate, and the scales larger. Our smaller specimen approaches *S. wieneri* in size of eye and shape of caudal more nearly than our larger one, though the specimen from which Sauvage drew his description was considerably larger than our large one.

The following, extracted from Sauvage's description, will show the degree of difference between these two species: Depth equal to length of head, which is contained  $4\frac{1}{2}$  in total length. Snout equal to interorbital space. Eye, 2 in snout;  $7\frac{1}{2}$  in head. Caudal, truncate. Lateral line, 85. Length, 57 cm.

Two specimens were collected at Callao, Peru, respectively 30 and 45 cm. in length. The latter is the type. It is deposited in the U. S. National Museum, Cat. No. 53464.

The cotype is in Stanford University museum.

I take pleasure in naming this species for Dr. C. H. Gilbert, to whom I owe the best of my ichthyological training.

#### 74. POLYCLEMUS PERUANUS Steindachner.

A single specimen from Callao, Peru, agrees very well with Doctor Steindachner's description of the type.

Head equals depth,  $3\frac{1}{2}$  in length without caudal. Eye  $6\frac{1}{2}$  in head; interorbital space,  $2\frac{1}{2}$ ; snout,  $3\frac{1}{2}$ ; maxillary,  $3\frac{1}{2}$ ; longest dorsal spine, 2; second anal spine, 4; longest soft anal ray, 2. Dorsal, X, I, 23; anal, II, 8. Scales of lateral line, 55.

This specimen does not show the dusky cross bands described by Jordan and Eigenmann from cotypes of the species in the Museum of Comparative Zoology.<sup>a</sup>

They describe the snout as being  $4\frac{1}{2}$  in length of head; and the eye  $4\frac{1}{2}$ . The specimen at hand agrees better with Doctor Steindachner's description (Schneuzenlänge nicht ganz 4 mal; Augendiameter bei erwachsenen individuen nahezu 6 mal). "Caudal fin slightly lunate or S-shaped"<sup>b</sup> does not adequately describe its shape. The lower half of the fin is obliquely truncate, the upper half lunate, thus leaving the fin angulated at the middle rays, which are as long as the angulated upper lobe.

#### 75. MICROPOGON ALTIPINNIS Günther.

A small specimen was collected at Guayaquil, Ecuador, which agrees in all essential characters with specimens from Panama. In comparing this species directly with *M. ectens* Jordan and Gilbert, it can be known at once by the enlarged scales on the side behind the pectoral

<sup>a</sup> Rept. U. S. Fish Comm., 1886, p. 415.

<sup>b</sup> Jordan and Eigenmann, Rept. U. S. Fish Comm., 1886.

and below the lateral line. There are three more scales counting the subvertical series between the median line of belly and lateral line in *M. altipinnis* than in *M. ectens* though the difference appears greater than the actual count indicates.

The occurrence of *M. ectens* at Panama may here be recorded. There is a specimen of this species in the Stanford University collections taken at Panama by the U. S. Bureau of Fisheries steamer *Albatross*, which has hitherto been identified with *M. altipinnis*. It agrees in all respects with specimens of the former species from Mazatlan, Mexico.

#### 76. CHILODACTYLUS VARIEGATUS Cuvier and Valenciennes.

Several specimens were collected at Callao. They all have the dorsal spines 17 in number, not 16 as recorded in the original description. The soft dorsal has from 29 to 31 rays, and the anal 9 or 10. The swollen lower rays of the pectoral number 6 (7 in original description), and extend from  $\frac{1}{2}$  to 1 diameter of the pupil beyond the branched rays. The gill rakers are rather slender, and number 12 or 13 on lower limb of arch.

### Family CICHLIDÆ.

#### 77. ÆQUIDENS RIVULATUS (Günther).

Several specimens taken at the market in Guayaquil and one at Eten, Peru. The longest 16 cm. in length.

Head,  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in length to base of caudal; depth,  $2\frac{1}{4}$ . Eye,  $3\frac{1}{2}$  to 4 in head in specimens from 7 to 9 cm. in length; 4 to  $4\frac{1}{2}$  in specimens from 11 to 16 cm. in length; maxillary, 3 to  $3\frac{1}{2}$ ; snout,  $2\frac{1}{2}$  to  $2\frac{3}{4}$ . Dorsal, XIV (occasionally XIII), 10 or 11; anal, III, 8 or 9. Scales, 26 or 27; 3 between front of dorsal and lateral line, 7 between front of anal and upper part of lateral line. Gill rakers, 3+8 or 9.

Small specimens up to 10 cm. in length have the anterior profile of head straight or slightly convex; large specimens, from 14 to 16 cm. in length usually have it slightly concave. Interorbital space increasing in width and growing more nearly flat with age; in large specimens its width is contained  $2\frac{3}{4}$  times in head; in small specimens 3 times. Length of dorsal and anal rays increasing with age; the longest ones 1 to  $1\frac{1}{2}$  in head in large specimens, and reaching past middle of caudal rays;  $1\frac{1}{2}$  in small specimens and not reaching to middle of caudal rays. Small specimens have the dark lateral spot much more conspicuous, and the dark lines radiating from eye to snout and across cheek much less conspicuous. They have narrow cross bars which are scarcely to be seen on specimens 13 cm. in length, and not at all on larger ones. These are placed as follows: One at base of caudal rays; one across caudal peduncle just behind soft dorsal; one under middle of soft dorsal; one just behind lateral spot; one just in front

of lateral spot; sometimes a faint trace of one under fourth or fifth dorsal spine. Body and fins of large specimens darker than in small ones, and more or less conspicuous, broken, longitudinal stripes follow the rows of scales on sides. The specimen from Eten, Peru, differs from the others in having the lower part of the head coal black up to a level with the mouth.

#### Family POMACENTRIDÆ.

##### 78. *CHROMIS CRUSMA* Cuvier and Valenciennes.

Two specimens from Callao, Peru.

#### Family EPHIPPIDÆ.

##### 79. *CHÆTODIPTERUS ZONATUS* (Girard).

One specimen from Guayaquil, Ecuador.

##### 80. *PARAPSETTUS PANAMENSIS* Steindachner.

Three specimens from Guayaquil differ from specimens from Panama only in being everywhere much darker.

#### Family BALISTIDÆ.

##### 81. *BALISTES NAUFRAGIUM* Jordan and Starks.

Six specimens from 15 to 17 cm. in length were obtained at Guayaquil, Ecuador. They agree in number of scales, fin rays, and proportions with specimens from Panama, but are much rougher. The first dorsal spine is more thickly set with spinules, making it thicker. The soft fin rays are constantly 26 in the dorsal and 24 in the anal. *B. adspersus* Tschudi, as described, has 24 rays in the dorsal and 20 in the anal, besides differing in depth, coloration, and minor characters. In these small specimens of *B. naufragium* and in specimens from Panama of a similar size the eyes are connected across the interorbital space by two narrow dark bars; one between the posterior orbital margins and one somewhat behind the anterior margins.

#### Family TETRAODONTIDÆ.

##### 82. *SPHEROIDES FURTHI* (Steindachner).

Four specimens 4 to 9 cm. in length from Guayaquil, Ecuador, seem to be referable to this species. It may be distinguished from other west coast species of this genus by the large eye as compared with the interorbital space and length of snout.

Head,  $2\frac{1}{2}$  to 3 in length to base of caudal. Eye,  $3\frac{1}{2}$  to 4 in head; interorbital space (bone) equal to eye; snout,  $2\frac{1}{2}$  to  $2\frac{1}{2}$ . Dorsal, 8; anal, 7.

Body short and stout; snout rather steep and slightly concave in profile. Prickles sharp and rather closely set on back from between front of eyes to within half a diameter of eye of dorsal. Patch of prickles on ventral surface covering a larger area; extending from a little in front of eyes to vent, sending a triangular area up between eye and gill opening nearly to dorsal patch; not extending above lower rays of pectoral on side of body. Entire side otherwise naked; no prickles on body behind vent. Caudal slightly lunate; the angles sharp.

Color dark brown on back and upper part of sides; mottled on sides by spots and bars running irregularly more or less obliquely. No color on area of prickles on ventral surface. The very small specimens show slightly the crossbars on back described by Steindachner in the original description. Base of pectoral dusky, but no dark band is present as described. Fins without markings.

### Family GOBIIDÆ.

#### 83. *PHILYPNUS LATERALIS* Gill.

Two specimens obtained at Guayaquil, Ecuador, and one at Eten, Peru; the largest 23 cm. in length.

The coloration of these specimens is scarcely so brilliant as in specimens of *P. dormitator* from the West Indies, though the contrary condition is alleged to exist. The scales number from 54 to 56, and the anal has constantly 11 rays.

#### 84. *ELEOTRIS PICTA* Kner and Steindachner.

Two large specimens were preserved from Guayaquil. They are black or very dark brown on upper parts and a clearer slightly lighter brown below, but with no white anywhere. The usual flecks of white on ventral parts so conspicuous in specimens from more northern localities, are at these only slightly lighter than the surrounding color and not noticeable. The fins are all black mottled with light gray, and the spinous dorsal has a light border. They do not otherwise differ from specimens from Lower California.

#### 85. *MAPO SOPORATOR* (Cuvier and Valenciennes.)

Specimens from Payta, Peru; and Guayaquil, Ecuador.

#### 86. *GOBIONELLUS SAGITTULA* (Günther).

Four small specimens from Guayaquil, Ecuador. They do not differ from specimens from the coast of Mexico, and San Diego, California, except in having the middle rays of the caudal a little longer.

### Family MALACANTHIDÆ.

#### 87. *CAULOLATILUS PRINCEPS* (Jenyns).

Four specimens from Callao, Peru.

## Family BATRACHOIDIDÆ.

88. *BATRACHOIDES PACIFICI* (Günther).

Specimens from Guayaquil, Ecuador.

## Family BLENNIIDÆ.

89. *LABRISOMUS PHILIPPI* (Steindachner).

Six specimens from Callao have the fin formulæ as follows: Dorsal, XIX, 13; anal, II, 19 in four specimens; dorsal, XIX, 12; anal, II, 19 in one specimen; dorsal, XVIII, 13; anal, II, 18 in one specimen. There is considerable discrepancy between our specimens and the original description in the size of the eye. The type was nearly 10 inches long and the eye was said to be  $4\frac{3}{4}$  in head, and  $1\frac{1}{2}$  in snout. In our specimens from 10 to 12 inches long the eye is from 6 to  $6\frac{1}{2}$  in head, and from 2 to  $2\frac{1}{2}$  in snout. In a specimen 7 inches long the eye is  $5\frac{1}{2}$  in head and  $1\frac{3}{4}$  in snout.

In some specimens light-blue spots and reticulations remain on the side of the head below the eye in addition to the dark-brown spots.

90. *HYPLEUROCHILUS PAYTENSIS* (Steindachner).

Two specimens were taken from rock pools at Payta, Peru, the type locality. They have 20 anal rays (one less than described for the type) and 17 and 15 dorsal rays, respectively (the type had 17).

## Family PLEURONECTIDÆ.

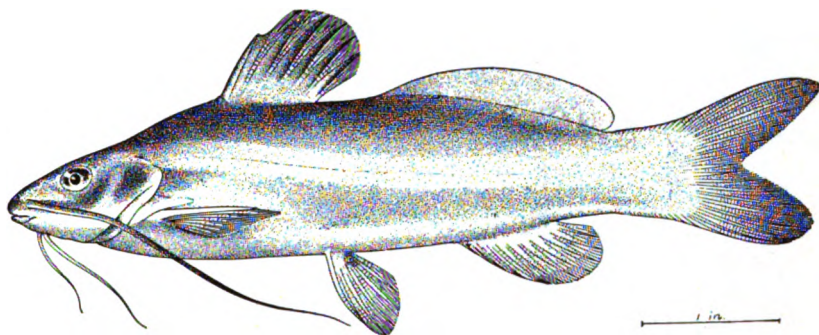
91. *PARALICHTHYS ADSPERSUS* (Steindachner).

One large specimen from Callao, Peru.

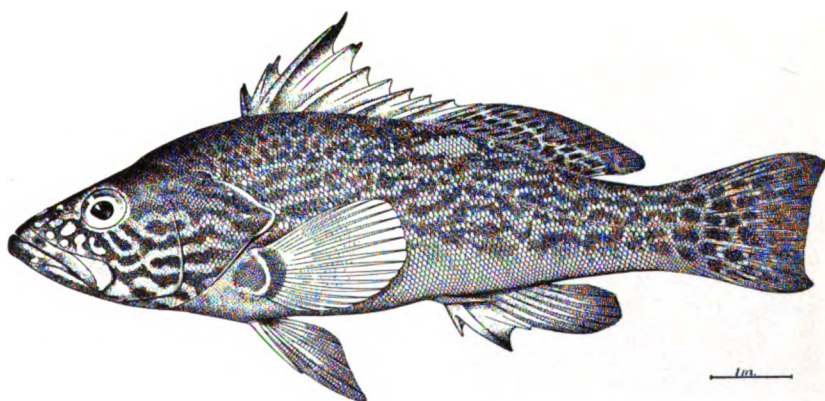
92. *CITHARICHTHYS GILBERTI* Jenkins and Evermann.

One specimen from Guayaquil is very dark brown in color but otherwise not different from specimens from Panama.

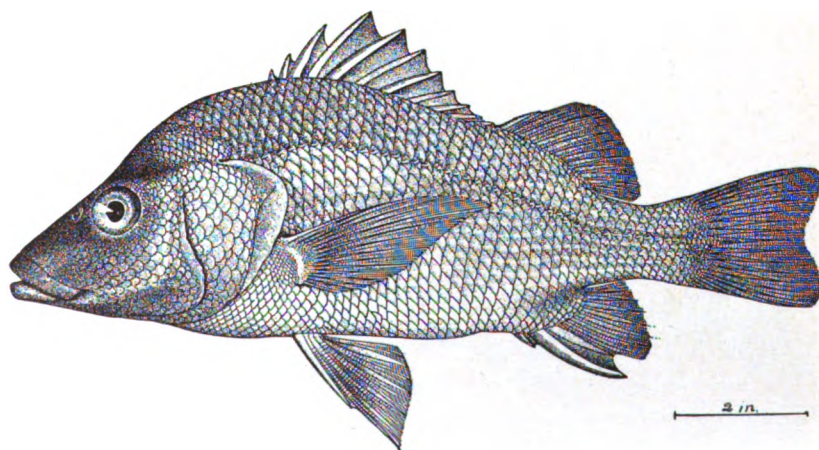
The scales on the eyed side of this species might better be described as finely ctenoid than ciliated.



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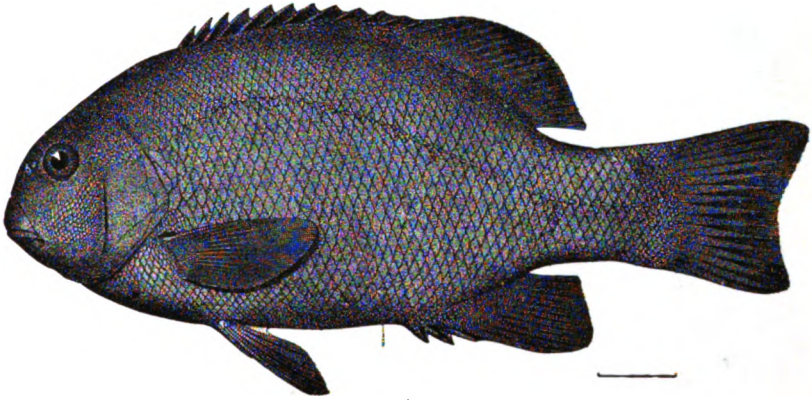
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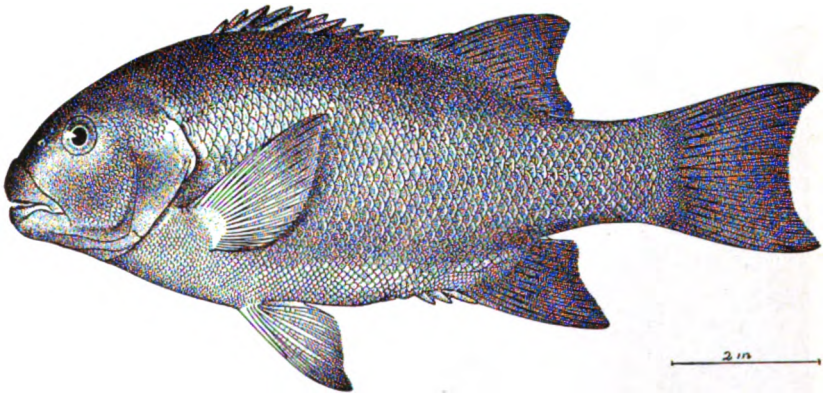
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1. RHAMDIA GILLI.
2. PARALABRAX CALLAENSIS.
3. POMADASIS BURRO.

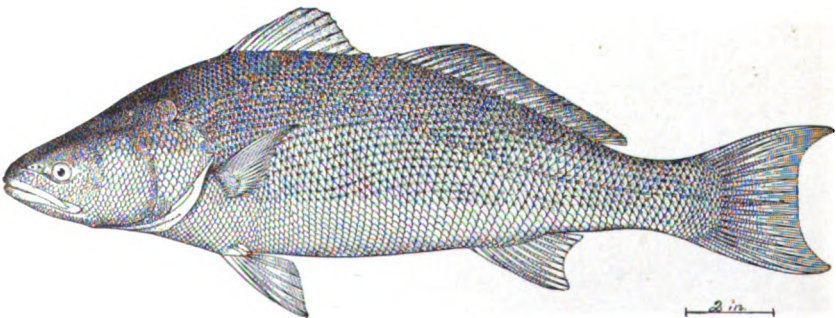




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3

1. DOYDIXODON FREMINVILLEI.
2. DOYDIXODON LAEVIFRONS.
3. SCIÆNA GILBERTI.



## NOTES ON BIRDS FROM GERMAN AND BRITISH EAST AFRICA.

By HARRY C. OBERHOLSER,

*Assistant Ornithologist, Department of Agriculture.*

Since the publication of the catalogue of birds collected by Dr. W. L. Abbott in the vicinity of Mount Kilimanjaro,<sup>a</sup> considerable material from neighboring regions has been examined, which throws light on some of the species involved. Besides U. S. National Museum specimens, there were a number from Mombasa, British East Africa, made available in the present connection through the kindness of Dr. W. J. Holland, director of the Carnegie Museum in Pittsburg, Pennsylvania, who has also obligingly permitted the inclusion here of notes on a number of interesting species not represented in Doctor Abbott's collection; and the writer's thanks are due him for this and other courtesies. For purposes of convenient collation, references to Doctor Holland's paper on Mombasa birds<sup>b</sup> are given under most of the species treated.

### Family CEDICNEMIDÆ.

#### **CEDICNEMUS VERMICULATUS VERMICULATUS** Cabanis.

*Oedicnemus vermiculatus* CABANIS, Journ. f. Ornith., 1868, p. 413 (East Africa).

A single specimen from Mombasa, recorded by Doctor Holland as *Edicnemus capensis*,<sup>c</sup> belongs undoubtedly to *O. vermiculatus*. It is a female in worn plumage, and is of interest from this northern locality, even though previously reported from the same place.

### Family COLUMBIDÆ.

#### **TURTUR SEMITORQUATUS INTERMEDIUS** Erlanger.

*Turtur semitorquatus intermedius* ERLANGER, Journ. f. Ornith., 1905, p. 124 (Roba-Schalo, lake region of southern Shoa, southern Abyssinia).

A specimen from Mombasa<sup>d</sup> is identical with others from Taveta and Mount Kilimanjaro, and belongs apparently to this form.

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<sup>a</sup> Oberholser, Proc. U. S. Nat. Mus., XXVIII, 1905, pp. 823-936.

<sup>b</sup> Ann. Carnegie Mus., III, 1905, pp. 453-463.

<sup>c</sup> Idem, p. 453.

<sup>d</sup> *Turtur semitorquatus* Holland, Ann. Carnegie Mus., III, 1905, p. 454.

**TURTUR CAPICOLA TROPICUS** Reichenow.

*Turtur capicola tropica* REICHENOW, Ornith. Monatsber., 1902, p. 139 (East Africa).

An example from Mombasa, recorded by Doctor Holland as *Turtur capicola damarensis*,<sup>a</sup> agrees with birds from the Kilimanjaro region in typically exhibiting the characters of *Turtur c. tropicus*.

**CHALCOPELIA CHALCOSPILA ACANTHINA** Oberholser.

*Chalcopelia chalcospila acanthina* OBERHOLSER, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 845 (Mount Kilimanjaro, German East Africa).

A specimen from Mombasa<sup>b</sup> is typical of the recently described northeastern race *Chalcopelia chalcospila acanthina*, agreeing perfectly with the type from Mount Kilimanjaro.

## Family PICIDÆ.

**CAMPETHERA ABINGONI MOMBASSICA** (Fischer and Reichenow).

*Picus* (*Campothera*) *mombassicus* FISCHER and REICHENOW, Journ. f. Ornith., 1884, p. 262 (Mombasa, British East Africa).

An adult male from Mombasa exhibits the characters of this subspecies and shows it to be one of the most distinct of the races of *Campethera abingoni*.

The four forms, *chrysura*, *abingoni*, *suahelica*, and *mombassica*, have been considered by Doctor Reichenow subspecies of *Campethera chrysura*,<sup>c</sup> but as *C. abingoni*<sup>d</sup> was the earliest of these races to be described it should furnish the specific term, and the birds be called *Campethera abingoni abingoni* (Smith).

*Campethera abingoni chrysura* (Swainson).

*Campethera abingoni suahelica* (Reichenow).

*Campethera abingoni mombassica* (Fischer and Reichenow).

**CAMPETHERA NUBICA PALLIDA** (Reichenow).

*Dendromus nubicus* var. *pallida* REICHENOW, Vögel Afrikas, II, 1903, p. 179 (Mpapua, German East Africa; and Barawa, Italian Somali Land).

An adult male from Mombasa<sup>e</sup> differs from Kilimanjaro and Taveta specimens in its paler colors, and agrees with Doctor Reichenow's diagnosis of *pallida*, indicating that this is a distinguishable race.

<sup>a</sup> Ann. Carnegie Mus., III., 1905, p. 454.

<sup>b</sup> *Chalcopelia chalcospila* Holland, Ann. Carnegie Mus., III, 1905, p. 454.

<sup>c</sup> *Dendromus chrysurus* Swainson, Birds West Afr., II, 1837, p. 158 (Senegal).

<sup>d</sup> *Chrysophilus abingoni* Smith, Rep. Exped. Explor. Cent. Afr., Append., 1836 p. 53 (Port Natal).

<sup>e</sup> *Dendromus nubicus* Holland, Ann. Carnegie Mus., III, 1905, p. 456.

**DENDROPICOS GUINEENSIS MASSAICUS** Neumann.

*Dendropicos guineensis massaicus* NEUMANN, Journ. f. Ornith., 1900, p. 206  
(Ndalalani, Nguruman Lake, Masai Land, German East Africa).

A specimen from Mombasa recorded by Doctor Holland as *Dendropicos hartlaubi*<sup>a</sup> is just like our Taveta specimens, and is further evidence of the propriety of recognizing this subspecies of *Dendropicos guineensis*.

## Family INDICATORIDÆ.

**MELIGNOTHES MINOR DIADEMATUS** (Rüppell).

*Indicator diadematus* RÜPPELL, Neue Wirb. Faun. Abyss., Vögel, 1835, p. 61  
(wooded region of Abyssinia).

Specimens from Mombasa recorded by Doctor Holland as *Indicator minor*<sup>a</sup> agree with the Kilimanjaro bird, and show that *M. m. diadematus* is the form occurring at that locality. As with most of the honey-guides, there is much individual variation in *diadematus*, but this does not vitiate the characters of the race. It is of valuable interest to note that Rüppell discovered the mistake he made when describing *Indicator diadematus*, and that after comparing his bird with a specimen of *minor* from the Cape of Good Hope he declared them identical.<sup>b</sup>

**MELIGNOTHES EXILIS MELIPHILUS** Oberholser.

*Melignother exilis meliphilus* OBERHOLSER, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 869. (Taveta, British East Africa).

In a paper appearing in the July issue of the Journal für Ornithologie,<sup>c</sup> and received since my paper was published, Erlanger states that *Indicator minor teitensis* Neumann<sup>d</sup> is a subspecies of *exilis*, not, as Doctor Reichenow intimates,<sup>e</sup> of *minor*. If this proves to be the case, I have probably redescribed *Melignother exilis teitensis* (Neumann) as *Melignother exilis meliphilus*, and the name *teitensis* of course should be used for this race; if not, the forms of *Melignother* stand as given in my previous paper.<sup>f</sup> The status of the other members of the genus is not affected by this change.

<sup>a</sup> Ann. Carnegie Mus., III, 1905, p. 456.

<sup>b</sup> Neue Wirb. Faun. Abyss., Vögel, 1835, p. 85; see also Oberholser, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 868.

<sup>c</sup> Journ. f. Ornith., July, 1905, pp. 464-467.

<sup>d</sup> Idem, 1900, p. 195 (Bura, Teita, British East Africa).

<sup>e</sup> Vögel Afrikas, II, 1902, p. 112.

<sup>f</sup> Proc. U. S. Nat. Mus., XXVIII, 1905, pp. 868-874.

## Family CORACIIDÆ.

**EURYSTOMUS AFER SUAHELICUS** Neumann.

*Eurystomus afer suahelicus* NEUMANN, Journ. f. Ornith., 1905, p. 186 (Tschara, Tana River, British East Africa).

One of the Mombasa specimens recorded by Doctor Holland<sup>a</sup> has been examined. It is apparently typical of the eastern race recently separated by Mr. Neumann.<sup>b</sup>

## Family MEROPIDÆ.

**MEROPS SUPERCILIOSUS SUPERCILIOSUS** Linnæus.

*Merops superciliosus* LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 183 (Madagascar).

Two specimens from Mombasa are apparently typical *M. superciliosus*, and show little or no approach to *Merops superciliosus donaldsoni* of Somali Land.<sup>c</sup>

## Family PLOCEIDÆ.

**AMBLYOSPIZA ALBIFRONS ÆTHIOPICA** Neumann.

*Amblyospiza aethiopica* NEUMANN, Ornith. Monatsber., 1902, p. 9 (Omo River, Malo, Abyssinia).

Two specimens from Mombasa examined belong to this race rather than to *Amblyospiza albifrons albifrons* to which they have been referred by Doctor Holland.<sup>d</sup>

**HYPHANTORNIS AUREOFLAVUS** (Smith).

*Ploceus aureoflavus* SMITH, Ill. Zool. S. Afr., Aves, 1839, text to pl. xxx, fig. 1 (Sierra Leone! [locality erroneous?]).

Three specimens of this species from Taveta, British East Africa, were inadvertently referred by the present writer<sup>e</sup> to *Hyphantornis bojeri*. In addition to other characters, *Hyphantornis aureoflavus* may be distinguished from *H. bojeri* in nearly all plumages by the less golden—more greenish—shade of both upper and lower parts.

## Family PYCNONOTIDÆ.

**PYCNONOTUS LAYARDI MICRUS** Oberholser.

*Pycnonotus layardi micrus* OBERHOLSER, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 891 (Taveta, British East Africa).

Examples from Mombasa<sup>f</sup> bear out the characters originally assigned to this race.

<sup>a</sup> *Eurystomus afer* Holland, Ann. Carnegie Mus., III, 1905, p. 457.

<sup>b</sup> *Eurystomus afer suahelicus* NEUMANN, Journ. f. Ornith., 1905, p. 186.

<sup>c</sup> *Merops superciliosus donaldsoni* Oberholser, Proc. U. S. Nat. Mus., XXVII, 1904, p. 737 (Bar Madu, Ganana River, Somali Land).

<sup>d</sup> Ann. Carnegie Mus., III, 1905, p. 460.

<sup>e</sup> Proc. U. S. Nat. Mus., XXVIII, 1905, p. 877.

<sup>f</sup> *Pycnonotus layardi* Holland, Ann. Carnegie Mus., III, 1905, p. 461.

## Family TIMALIIDÆ.

**BESSONORNIS SUBRUFESCENS INTERCEDENS** Cabanis.

*Bessonornis intercedens* CABANIS, Journ. f. Ornith., 1878, pp. 205, 218 (Kitui, Ukamba, British East Africa).

A single adult male collected by Dr. W. L. Abbott at 5,000 feet altitude on Mount Kilimanjaro, July 22, 1888, was recently recorded as *Cossypha heuglini intermedia*.<sup>a</sup> The present opportunity of comparing it with a series of true *Bessonornis* (= *Cossypha*) *heuglini intermedia*<sup>b</sup> from Mombasa shows that it belongs to the other species (*B. rufescens*) which differs from *B. heuglini* in its darker and slate-colored instead of olive-brown upper surface; blackish middle tail-feathers, and less extensive white superciliary stripes that do not meet across the forehead as in *heuglini*. The original description of *Bessonornis subrufescens*<sup>c</sup> was based on specimens from Caconda, Angola, and therefore represents the West African form, from which the *Bessonornis intercedens* of Cabanis<sup>d</sup> seems to differ sufficiently in its smaller size and less blackish tail-feathers to stand as a subspecies.

Our attention has been called by Mr. W. E. C. Todd to the fact that *Cossypha*,<sup>e</sup> the name in common use for the present genus, is preoccupied in entomology (Coleoptera) by *Cossyphus* Fabricius;<sup>f</sup> it therefore will have to give way to *Bessonornis* Smith.<sup>g</sup>

## Family SYLVIIDÆ.

**CISTICOLA HYPOXANTHA** Hartlaub.

*Cisticola hypoxantha* HARTLAUB, Proc. Zool. Soc. Lond., 1880, p. 624 (Magungo, northeastern end of Lake Albert Nyanza, British East Africa).

This species, based upon a single immature specimen, has hitherto been almost uniformly synonymized with *Cisticola rufa*, notwithstanding its widely separated range. Four specimens, however, collected by Mr. Doherty at Mombasa, and recorded by Doctor Holland<sup>h</sup> as "*Cisticola aff. rufæ* (?), sp. nov. (?) vel. *rufæ* subspecies," prove beyond much doubt that it is quite distinct, differing from *Cisticola rufa* of western Africa in its less uniform upper surface, the pileum

<sup>a</sup> Oberholser, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 894.

<sup>b</sup> *Bessonornis intermedia* Cabanis, von der Decken's Reisen, III, 1869, Pt. 1, p. 22, pl. XII (coast of East Africa).

<sup>c</sup> *Cossypha subrufescens* Bocage, Proc. Zool. Soc. Lond., 1869, p. 436.

<sup>d</sup> Journ. f. Ornith., 1878, p. 205.

<sup>e</sup> Vigors, Zool. Journ., II, 1826, p. 396 (type, *Turdus vociferans* Swainson = *Muscicapa bicolor* Sparrman).

<sup>f</sup> Ent. Syst., I, Pt. 2, 1792, p. 97.

<sup>g</sup> Rep. Exped. Explor. Cent. Africa, App., 1836, p. 46 (misprinted *Dessonornis*; type *Dessonornis humeralis* Smith).

<sup>h</sup> Ann. Carnegie Mus., III, 1905, p. 462.

being much more rufescent than the back and like it streaked with darker brown or blackish; in its lack of a perceptible superciliary stripe; much paler buffy breast, sides, and flanks; white, or at most only pale buffy lower tail-coverts; and buffy white instead of rufous inner margins of the wing-quills. It probably ranges over most if not all of British East Africa.

The adult of this species, which appears to have been hitherto unknown, may be described as follows:

Male, Cat. No. 8136, Carnegie Museum; Mombasa, British East Africa, September or October, 1900; William Doherty. Pileum and cervix mummy brown, the feathers of the former with darker centers; back, scapulars, and rump hair brown, rufescent anteriorly, the feathers, except on the rump, with dark brown shaft streaks; upper tail-coverts mummy brown; tail bistre brown, the middle pair of rectrices with an obsolete subterminal band of darker, the remaining ones with more or less extensive grayish or buffy tips and blackish subterminal bars; wings fuscous, the secondary coverts and tertials broadly margined with hair brown, more rufescent on the greater coverts; the primary coverts, primaries, and secondaries edged externally with rufescent bistre brown; lores, a narrow eye ring, cheeks, and auriculars buff, the last mixed with pale brownish; sides of neck brown like the nape, but considerably lighter; chin, middle of throat and abdomen, with lower tail-coverts, creamy white; remainder of under parts cream buff, deeper on sides and flanks; lining of wing pale cream buff; inner margins of wing-quills dull buffy whitish.

The immature bird, on which the original description of *melano-xantha* was based, and of which there are two specimens in the Doherty collection, differs from the adult in being almost uniformly pale yellowish below, and more uniform dull rufescent or yellowish brown on the upper parts, the pileum scarcely more rufescent than the back.

Measurements of this species are given below.

| Sex and age.       | Locality.                     | Date.                       | Wing.       | Tail.       | Exposed culmen. | Tarsus.     |
|--------------------|-------------------------------|-----------------------------|-------------|-------------|-----------------|-------------|
| Female adult.....  | Mombasa, British East Africa. | September or October, 1900. | mm.<br>43.5 | mm.<br>34.5 | mm.<br>10.5     | mm.<br>18.0 |
| Do.....            | do.....                       | do.....                     | 44.0        | 32.0        | 9.5             | 17.0        |
| Male juvenile..... | do.....                       | do.....                     | 47.5        | 41.0        | 9.5             | 17.0        |
| Female juvenile .. | do.....                       | do.....                     | 44.0        | 38.0        | 8.5             | 17.5        |
| Average.....       | .....                         | .....                       | 44.8        | 36.4        | 9.5             | 17.4        |

**SYLVIETTA WHYTII JACKSONI** Sharpe.

*Sylviella jacksoni* SHARPE, Bull. Brit. Orn. Club, VII, 1897, p. vii (Kamassia, British East Africa).

A single specimen from Mombasa, recorded by Doctor Holland as *Sylviella micrura*,<sup>a</sup> is identical with the example collected by Doctor Abbott at Taveta, and substantiates our remarks concerning the status of *Sylvietta whytii jacksoni*.<sup>b</sup>

**PRINIA MISTACEA** Rüppell.

*Prinia mistacea* RÜPPEL, Neue Wirb. Faun. Abyss., Vögel, 1835, p. 110 (Gondar, Abyssinia).

Immature birds of this exceedingly variable species differ considerably from the adults in their paler upper surface, more rufescent wing margins, and pale bills, this last a characteristic of both male and female, as is shown by two specimens from Mombasa.<sup>c</sup>

## Family MUSCICAPIDÆ.

**BATIS SENEGALENSIS ORIENTALIS** (Heuglin).

*Platystira orientalis* HEUGLIN, Ornith. Nordost-Afr., I, 1871, p. 449 (Abyssinia).

A specimen from Mombasa<sup>d</sup> is typical of this form.

**PLATYSTEIRA CRYPTOLEUCA** Oberholser.

*Platysteira cryptoleuca* OBERHOLSER, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 913 (Useri River, plains of Mount Kilimanjaro, British East Africa).

Specimens from Mombasa, recorded by Doctor Holland as *Platysteira peltata*,<sup>e</sup> agree with the type of *cryptoleuca* in having the large concealed patch of white on the nape, but both male and female sometimes have concealed white spots on the rump, from which it appears that their absence is not constantly diagnostic of *cryptoleuca*, as supposed.

**TCHITREA FERRETI** Guérin.

*Tchitre ferreti* GUÉRIN, Rev. Zool., 1843, p. 162 (Abyssinia).

Examination of considerable additional material since the publication of my previous notes on *Tchitre suahelica*<sup>f</sup> seems to throw light on the relationships of *Tchitre suahelica*, *T. perspicillata*, and *T. viridis* (= *T. cristata* Authors).

<sup>a</sup> Ann. Carnegie Mus., III, 1905, p. 463.

<sup>b</sup> Proc. U. S. Nat. Mus., XXVIII, 1905, p. 906.

<sup>c</sup> These are numbers 8131 and 8132, Carnegie Museum, which were inadvertently recorded by Doctor Holland (Ann. Carnegie Mus., III, 1905, p. 462) under "*Cisticola aff. rufa*."

<sup>d</sup> *Batis senegalensis* Holland, Ann. Carnegie Mus., III, 1905, p. 458.

<sup>e</sup> Ann. Carnegie Mus., III, 1905, p. 458.

<sup>f</sup> Proc. U. S. Nat. Mus., XXVIII, 1905, p. 915.

There seems to be little doubt that the birds from Abyssinia and other parts of northeastern Africa, which represent *Tchitreia ferreti* Guérin,<sup>a</sup> are identical with those from East Africa which Doctor Reichenow has called *T. suahelica*;<sup>b</sup> and the proper name for both is therefore *Tchitreia ferreti* Guérin. Mr. Oscar Neumann in a recent connection<sup>c</sup> has revived this name for the Abyssinian bird, which he found to differ from the west African *T. viridis*, and of which he made it a subspecies, but he appears to be unacquainted with Reichenow's *T. suahelica*, or at least not to have suspected its relationship to *T. ferreti*.

The present study has but confirmed the opinion previously expressed<sup>d</sup> that *Tchitreia ferreti* (i. e., *Tchitreia suahelica*) is a perfectly distinct species, although in some respects intermediate between *T. perspicillata* and *T. viridis*, or, as it might possibly be more accurately stated, combining their characters. In its chestnut-backed plumage, of all stages except the very young, and even before the long central tail-feathers appear, it differs from *Tchitreia perspicillata* in its more blackish wing-quills; black primary coverts and outermost secondary coverts; broad white instead of rufous edgings to the exterior webs of most of the primaries, secondaries, primary coverts, and outer secondary coverts; more bluish head and upper throat; less purely white lining of wings, and less whitish abdomen. In its white plumage, to which there seems to be no corresponding stage in *T. perspicillata*, it of course differs additionally by reason of its white back and tail. From *Tchitreia viridis* of western Africa it may readily be distinguished in rufous-backed plumage, by the white or at most very pale rufous lower tail-coverts; much less uniform lower surface, the abdomen being much paler—on the anal region sometimes even whitish—and the metallic bluish of the throat less extended posteriorly; grayish or rufescent white instead of plain slate-colored lining of wings, including axillars; and more extensive white margins of the wing-quills and coverts. In the white-backed plumage, however, these two species are, like some of the oriental forms of this genus, much more difficult to distinguish, but *T. ferreti* may be identified by its paler abdomen, less posterior extension of the metallic blue of the throat, white lower tail-coverts, more whitish lining of wing, and rather broader and more extensive white margins of the wing-quills and coverts, although it must be said that all of these characters, excepting the first two, are to some extent uncertain.

So far as *Tchitreia perspicillata* is concerned with *T. viridis*, there is comparatively little real need for comparison, as it differs much more

<sup>a</sup> Rev. Zool., 1843, p. 162.

<sup>b</sup> *Terpsiphone perspicillata suahelica* Reichenow, Werth. Mittl. Hochl. deutsch. Ost-Afr., 1898, p. 275.

<sup>c</sup> Journ. f. Ornith., 1905, pp. 211-213.

<sup>d</sup> Oberholser, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 915.

than from *T. ferreti*, or than even does the latter from *T. viridis*. However, from *T. viridis* in rufous-backed stage, *T. perspicillata* may readily be distinguished by its brown instead of black wing-quills; uniform rufous wing without white edgings or black coverts; extensively white lining of wing; whitish abdomen; white under tail-coverts; paler breast; and more greenish metallic shade of head and throat, which color is less extended posteriorly on the lower surface.

The geographical distribution of these three species is about as follows:

*Tchitrea perspicillata* (Swainson).—Southeastern Africa, north to near the Zambesi River.

*Tchitrea ferreti* Guérin (= *Tchitrea perspicillata suahelica* [Reichenow]).—Eastern and northeastern Africa, from the Zambesi River to Abyssinia and Somali Land.

*Tchitrea viridis* (Müller) (= *Tchitreu cristata* [Gmelin]).—Western Africa, from Ségambia to Gabun.

#### Family LANIIDÆ.

##### POMATORHYNCHUS SENEGALUS ARMENUS, new subspecies.

*Chars. subsp.*—Similar to *Pomatorhynchus senegalus senegalus* in size and general color, but upper parts more rufescent, the anterior portion of the superciliary stripe tinged with ochraceous instead of being pure white; lower surface more washed with buffy.

*Description.*—Type, adult male, No. 118,148 U.S.N.M.; Plains of Taveta, British East Africa, June 28, 1888; Dr. W. L. Abbott. Pileum, lores, and postocular streak black; superciliary stripe ochraceous buff, paler anteriorly; upper and lower eyelids white; cheeks buffy whitish; auriculars and sides of neck tawny clay color; cervix, back, and scapulars reddish chestnut, the last with broad brownish black centers; rump and upper tail-coverts hair brown; middle tail-feathers broccoli brown, numerous and narrowly barred with darker brown; remaining rectrices black, with broad white tips which increase in size on the outer feathers, the two outermost also narrowly margined with whitish on the distal portion of their outer webs; wing-quills fuscous, broadly edged externally with ferruginous, the tertials also bordered on both webs with a lighter shade of the same; superior wing-coverts ferruginous, the greater series with narrow shaft markings of blackish; ventral surface white, washed with buffy, particularly on the lower tail-coverts; the breast, sides, and flanks more or less shaded with grayish; edge of wing white; lining of wing and inner edges of wing-quills basally tawny.

Two of the specimens on which the description of this form is based were recently recorded as *Pomatorhynchus senegalus senegalus*,<sup>a</sup> but

<sup>a</sup>Oberholser, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 923.

the comparison of further material shows that the bird from South Africa and most of East Africa differs subspecifically from that of western and northwestern Africa, as above set forth. Apparently this southern race has hitherto received no name that can be used for it, since all the synonyms of the species are otherwise applicable. The original *Lanius senegalus*<sup>a</sup> was of course based on the bird from Senegal; *Lanius erythropterus* Shaw,<sup>b</sup> in so far as it relates to the present species, is from the same region, as indicated by the description and part of the synonymy cited, i. e., "La Pie-Grièche rousse à tête noire du Sénégal" of Daubenton,<sup>c</sup> although it is evident that Shaw had confused the two species *Pomatorhynchus senegalus* and *Pomatorhynchus tschagra*; *Tschagra senegalensis* Lesson<sup>d</sup> is also from Senegal; and *Lanius coronatus* Vieillot<sup>e</sup> from an unknown locality is evidently applicable to the same form; while the *Pomatorhynchus orientalis* of Cabanis,<sup>f</sup> from Mombasa, is subspecifically different from both *senegalus* and the present race, as shown below.

Measurements of *Pomatorhynchus senegalus armenus* are as follows:

| Sex.       | Locality.   | Date.         | Wing.  | Tail.  | Exposed culmen. | Tarsus. |
|------------|---|---------------|--------|--------|-----------------|---------|
| Male ..... | Plains of Taveta, British East Africa. <sup>a</sup> | June 28, 1888 | mm. 82 | mm. 93 | mm. 19.5        | mm. 29  |
| Do .....   | Taveta, British East Africa                         | May 1, 1888   | 87     | 101    | 19.5            | 28      |
|            | South Africa  |               | 86     | 103    | 20.0            | 33      |
|            | Average .....                                       |               | 85     | 99     | 19.7            | 30      |

<sup>a</sup> Type.

#### POMATORHYNCHUS SENEGALUS ORIENTALIS Cabanis.

*Pomatorhynchus orientalis* CABANIS, von der Decken's Reisen, III, 1869, p. 27, in text (Mombasa, British East Africa).

A series of eight specimens from Mombasa, the type locality, shows that this form, hitherto usually considered inseparable from *Pomatorhynchus senegalus*, is well worthy of recognition. It differs from true *P. senegalus* of western Africa in its inferior size, more slender bill, and decidedly paler upper surface; and from *P. senegalus armenus* by reason of its smaller size, much paler, more grayish upper surface, and less buffy lower parts.

<sup>a</sup> Linnaeus, Syst. Nat., 12th ed., I, 1766, p. 137.

<sup>b</sup> Gen. Zool., VII, Pt. 2, 1809, p. 301.

<sup>c</sup> Pl. Enl., pl. CCCCLXXIX, fig. 1.

<sup>d</sup> Traité d'Ornith., 1831, p. 373.

<sup>e</sup> Nouv. Dict. d'Hist. Nat., XXVI, 1818, p. 140.

<sup>f</sup> Von der Decken's Reisen, III, 1869, p. 27, in text.

Measurements are as below:

| Sex.       | Locality.                     | Date.                       | Wing. | Tail. | Exposed<br>culmen. | Tarsus. |
|------------|-------------------------------|-----------------------------|-------|-------|--------------------|---------|
|            |                               |                             | mm.   | mm.   | mm.                | mm.     |
| Male ..... | Mombasa, British East Africa. | September or October, 1900. | 71.0  | 75    | 17.5               | 25.0    |
| Do.....    | do .....                      | do .....                    | 77.5  | 85    | 20.0               | 28.0    |
| Do.....    | do .....                      | do .....                    | 86.0  | 92    | 21.0               | 29.0    |
| Do.....    | do .....                      | do .....                    | 81.0  | 89    | 20.0               | 29.0    |
| Do.....    | do .....                      | do .....                    | 83.5  | 94    | 21.0               | 29.5    |
|            | Average .....                 |                             | 79.8  | 87    | 19.9               | 28.1    |

There are thus three forms of *Pomatorhynchus senegalus*, whose names and geographical ranges are as follows:

*Pomatorhynchus senegalus senegalus* (Linnaeus).—Western and northwestern Africa.

*Pomatorhynchus senegalus armenus* Oberholser.—South Africa and eastern Africa north to the Kilimanjaro region.

*Pomatorhynchus senegalus orientalis* Cabanis.—Coast region of British East Africa, and probably northward.

### Family NECTARINIIDÆ.

#### CINNYRIS OLIVACEA RAGAZZII (Salvadori).

*Eleocerthia ragazzii* SALVADORI, Ann. Mus. Stor. Nat. Genova, Ser. 2<sup>a</sup>, VI (XXVI), 1888, p. 247 (Fekerie Ghem forest, Shoa, Abyssinia).

Specimens from Mombasa<sup>a</sup> are identical with those from Kilimanjaro, and serve even more clearly to emphasize the distinctness of this race.

### Family HIRUNDINIDÆ.

#### HIRUNDO PUELLA ABYSSINICA Guérin.

*Hirundo abyssinica* GUÉRIN, Rev. Zool., 1843, p. 322 (Abyssinia).

Specimens from Mombasa<sup>b</sup> are very typical of this eastern subspecies, and agree perfectly with birds from Mount Kilimanjaro.

### Family FRINGILLIDÆ.

#### PASSER SWAINSONI GONGONENSIS (Oustalet).

*Pseudostruthus gongonensis* OUSTALET, Le Naturaliste, 1890, p. 274 (Gongoni, near Mombasa, British East Africa).

This large, pale form replaces true *Passer swainsoni* in southern Somali Land and in British East Africa, but is quite certainly only subspecifically distinct. A specimen in the Doherty collection, from Mombasa,<sup>c</sup> belongs to this race.

<sup>a</sup> *Chalcomitra obscura ragazzii*, Holland, Ann. Carnegie Mus., III, 1905, p. 462.

<sup>b</sup> *Hirundo puella* Holland, Ann. Carnegie Mus., III, 1905, p. 457.

<sup>c</sup> *Passer swainsoni* Holland, Ann. Carnegie Mus., III, 1905, p. 461.



## DESCRIPTION OF A NEW SPECIES OF THREADFIN (FAMILY POLYNEMIDÆ) FROM JAPAN.

By DAVID STARR JORDAN and RICHARD CRITTENDEN MCGREGOR,  
*Of Stanford University, California.*

In this paper is given an account of the single species which represents in Japan the tropical family of *Polynemidæ* or Threadfins.

### Family POLYNEMIDÆ.

Body oblong, compressed, and covered with rather large, loosely inserted, ctenoid scales. Lateral line continuous, continued on the tail, usually forked, with a branch on each lobe. Head entirely scaly; snout more or less conical, projecting over the mouth, which is rather large, inferior, with lateral cleft; premaxillary protractile, its basal process vertical; maxillary without supplemental bone, extending much beyond the eye, which is anterior, lateral, rather large, with a well-developed, adipose eyelid. Villiform teeth on jaws, palatines, and sometimes on vomer. Pseudo-branchiæ concealed. Branchiostegals 7. Gill membranes separate and free from the isthmus. Gills, 4, a slit behind the fourth. Two separate dorsals, somewhat remote from each other, the first of 8 feeble but rather high spines, the first and last spines very short, the third longest; the second dorsal equal to first in height, but base somewhat longer, of soft rays only. Anal fin either similar to or much longer than soft dorsal; caudal fin rather long, widely forked. Second dorsal, anal, and caudal fins more or less covered with small scales; the first 3 or 4 dorsal spines winged. Ventrals 1, 5, abdominal, but not far removed from pectorals; pectoral fins moderate, placed low, in two parts, the lower and anterior portion of several filiform articulated appendages, free from each other, used as organs of touch. In the young the dorsal, caudal, and pectoral fins are dusky, the anal and ventral fins white; all the fins grow darker with age, the pectorals usually becoming black, the operculum blackish. Bones of the skull with a well-developed muciferous system as in *Sciænidae*. Basis cranii double, with muscular tube; post-temporal

bifurcate; hypercoracoid with median foramen; superior pharyngeal bones 4. Pectoral actinosts divided; 2 of them normal, supporting the pectoral fin, 1 longitudinal, without rays, and 1 a plate on the coracoid, supporting the pectoral filaments. Stomach cœcal, with a few pyloric appendages. Air bladder various, sometimes wanting. Vertebrae  $10 + 14 = 24$ . Genera 4, *Galeoides*, *Polistonemus*, *Polynemus*, and *Polydactylus*; the species inhabiting sandy shores of tropical seas, and sometimes entering rivers. Most of them are valued as food-fishes, their flesh resembling that of the Sciaenidæ. The relations of this peculiar family appear to be with the Sciaenidæ on the one hand, and with the Mugilidæ on the other, but all these resemblances may be superficial.

#### POLYDACTYLUS Lacépède.

*Trichidion* KLEIN, *Historia Piscium*, Missus., 1749, V, p. 28 (*Piracouba* MARC-GRAVE=*virginicus*), (non-binomial).

*Polynemus* LINNÆUS, *Syst. Nat.*, 10th ed., 1758, p. 317 (in part, *quinquarius*; *virginicus*; *paradisæus*).

*Polydactylus* LACÉPÈDE, *Hist. Nat. Poiss.*, 1832, VIII, p. 181, (*plumieri*=*virginicus*), (leaving *Polynemus* as the name of *quinquarius*).

*Polynemus* GÜNTHER, *Cat.*, 1860, II, p. 319 (*paradisæus*).

*Trichidion* GILL, *Proc. Ac. Nat. Sci. Phila.*, 1861, p. 274 (*plumieri*=*virginicus*).

Anal fin not much longer than soft dorsal, of about 13 or 14 rays; vomer with teeth; preoperculum serrate; free filaments of pectorals mostly shorter than body. Teeth in villiform bands on both jaws, vomer, palatines, and pterygoids. Preopercle sharply serrated on its posterior margin, its angle with a scaly flap. Scales rather small, finely ctenoid. First dorsal with 7 or 8 feeble, rather high spines, the first and last short. Soft dorsal and anal fins about equaling each other; pectoral filaments 3 to 9. Pyloric cœca in great number. Species numerous in warm seas, one of them reaching the shores of Japan.

(πολύς, many; δάκτυλος, finger.)

#### POLYDACTYLUS AGONASI Jordan and McGregor, new species.

AGONASHI (WITHOUT JAW); TSUBAME-KONOSHIRO (SWALLOW-TAIL SHAD).<sup>a</sup>

*Polynemus plebeius* SCHLEGEL, *Fauna Japonica*, 1845, p. 29, pl. xi, fig. 1; Nagasaki; (not *Polynemus plebejus* of Broussonet, a species from Tahiti=*Polynemus lineatus* GÜNTHER; not *Polynemus plebejus* GÜNTHER, *Cat.*, II, p. 329=*Polynemus zophomus* JORDAN and MCGREGOR, new name, an Indian species with larger scales and a black humeral spot.—NAMIYE, *Class. Cat.*, 1881, p. 94; Tokyo.—ISHIKAWA, *Prel. Cat.*, 1894, p. 45; Tokyo; Kagoshima.

*Polydactylus plebeius* JORDAN and SNYDER, *Proc. U. S. Nat. Mus.*, XXIII, 1900, pp. 358, 752; Tokyo, Yokohama.—JORDAN and SNYDER, *Check List*, 1901, p. 85; Yokohama.

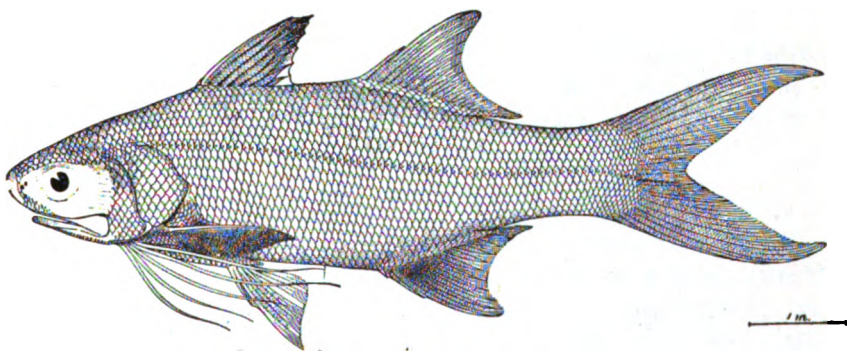
Head,  $3\frac{1}{2}$  in length to base of caudal; depth,  $3\frac{1}{2}$ .

<sup>a</sup> Tsubame—a swallow; konoshiro—a gizzard shad (*Konosirus punctatus*).

Dorsal, VIII-I, 13; anal, III, 12; scales, 68; 5 free pectoral rays, the longest reaching tip of ventral; eye, 4 in head; scales rather small, ctenoid.

This species, the common *Polydactylus* of Japan, locally known as *Agonashi* (the fish without a jaw), was referred by Schlegel to *Polydactylus plebejus* Broussonet, a common species of the coral reefs of the South Pacific originally described from Tahiti. From this species it differs notably in color and also in minor details of form. The two are, however, closely related.

In form *Polydactylus agonasi* is very similar to *P. plebejus*, but the coloration of the two species is different; in *P. plebejus* the general color is very dark, the fins are almost black and the body is brown;



POLYDACTYLUS AGONASI.

above the lateral line there is a series of narrow dark brown lines extending along the entire side of body; opposite base of second dorsal there are 7 of these dark lines above lateral line; below lateral line they are faintly developed.

The coloration in *P. agonasi* in alcohol is pale silvery yellow; first dorsal and pectoral speckled with dark brown. There are no dark stripes, or mere traces of streaks along the rows of scales.

In *P. plebejus* the second dorsal and anal are more concave and caudal more falcate than in *P. agonasi*; the scales are of the same size in the two species.

The type of *Polydactylus agonasi* (Tokyo, K. Otaki) is numbered 55600, U.S.N.M., two other specimens (cotypes, No. 9879, Stanford University) are in Stanford University from Tokyo.

The species was found by Jordan and Snyder rather common at Nagasaki and somewhat rare in the markets of Tokyo.

The specimens from Kotosho, Formosa, recorded by Jordan and Evermann,<sup>a</sup> with the scales 50, belongs apparently to *Polydactylus zophomus*.

<sup>a</sup>Proc. U. S. Nat. Mus., XXV, p. 351.



## A NEW TREE TOAD FROM COSTA RICA.

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By LEONHARD STEJNEGER,

Curator, Division of Reptiles and Batrachians.

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Some time ago the United States National Museum acquired a small but well-preserved collection of batrachians made in Costa Rica by Messrs. Burgdorf and Schild. Among several interesting species there is a new *Hyla* which it is desirable to place on record now.

### HYLA PHLEBODES, new species.

*Diagnosis.*—Skin of head not involved in cranial ossification; choanæ moderate; vomerine teeth in two small groups, on a level with the posterior edge of the choanæ; outer fingers one-fourth webbed; tympanum one-third the diameter of the eye; tibio-tarsal articulation reaching the tip of snout; no tarsal fold; a distinct inner metatarsal tubercle.

*Habitat.*—Costa Rica.

*Type.*—Cat. No. 29970, U.S.N.M.; San Carlos, Costa Rica; Burgdorf and Schild, collectors.

*Description of type.*—Adult female: Tongue nearly circular, scarcely emarginate behind; vomerine teeth in two very small groups on a level with the posterior edge of the moderately large choanæ, each group consisting of about four teeth, the distance between the groups equaling their diameter; head moderate, slightly broader than long; snout short, shorter than diameter of eye, slightly rounded, not projecting; canthus rostralis rounded; loreal region somewhat concave; interorbital space broader than upper eye-lid; tympanum distinct, about one-third the diameter of eye; outer fingers one-fourth webbed, inner with a rudiment of web at base only; no projecting pollex; toes nearly fully webbed; disks of digits smaller than tympanum; subarticular tubercles moderate; inner metatarsal tubercle distinct, about one-third the length of inner toe, outer one very indistinct; no tarsal fold; tibio-tarsal articulation of hind limb carried forward reaches the tip of snout; upper surface shagreened with scattered indistinct warts;

throat smooth, rest of underside coarsely granular; a strong fold from posterior angle of eye above tympanum to shoulder; a sharp fold from side of neck to groin, and a very strong one across the chest from one arm to the other. Color (in alcohol) above vinaceous drab with a coarse network of dark purplish reticulations; tibia with a number of narrow cross lines of the same color; underside uniform whitish.

*Dimensions.*

|   | Mm. |
|---|-----|
| Total length, tip of snout to vent.....           | 27  |
| Width of head .....                               | 9   |
| Length of fore limb .....                         | 17  |
| Length of hind limb from vent to longest toe..... | 47  |

## THE MAMMALS OF ENGANO ISLAND, WEST SUMATRA.

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By GERRIT S. MILLER, Jr.,  
*Assistant Curator, Division of Mammals.*

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The mammal fauna of Engano Island was first made known in 1894, when Mr. Oldfield Thomas published an account of the collections made there three years before by Doctor Modigliani.<sup>a</sup> Twelve species, mostly bats, were recorded, one of which, *Pteropus modiglianii*, was described as new. A second new species has recently been described from Doctor Modigliani's collection, *Rhinolophus calypso* Andersen,<sup>b</sup> but with this exception no further accounts of the mammals have appeared.

Engano was visited in November and December, 1904, by Dr. W. L. Abbott. He collected about 70 mammals, all of which have been presented to the United States National Museum. Among them are three not taken by Doctor Modigliani.

Doctor Abbott's description of the island is as follows:

"Engano lies about 60 miles south of [Manna Point on] the coast of southwest Sumatra. It is about 18 miles long and contains about 140 square miles. Near the coast it is flat, but in the interior it rises so that the whole interior looks like a low, flat hill when viewed from the sea. On the charts the highest point is given as 1,060 feet, but this is undoubtedly too high. The whole coast line is formed by a reef from  $\frac{1}{2}$  mile to  $1\frac{1}{2}$  miles wide. The best anchorage is behind Pulo Dua, in the bay at the southeast corner of the island. The peculiar natives are rapidly dying out, only 441 being left on December 5, 1904. The population was 6,500 in 1868. The country is covered with scrub and forest. Much of it has evidently been cleared and is now overgrown. A good road starts from opposite Pulo Dua and runs two-thirds around the island; about 40 miles. The soil appears to be very fertile, and there is but little rock visible on the surface. The rainfall is abundant, and there are many streams and rivers. Pulo Dua is about  $\frac{1}{2}$

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<sup>a</sup>On some mammals from Engano Island, west of Sumatra. Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, pp. 105-110. April 10, 1894.

<sup>b</sup>Proc. Zool. Soc. London, 1905, II, p. 134. October 17, 1905. Proc. U. S. Nat. Mus., XXIX, p. 657. March 7, 1906.

mile long and nearly covered with cocoanuts. It lies about 1 mile from the main island. There is a kampong on it, where the Malay mentri (government clerk) lives. Pulo Mirbau is about  $1\frac{1}{4}$  miles south of Pulo Dua. It contains 10 or 15 acres. There were here many fruit pigeons and a camp of *Pteropus*."

#### SYSTEMATIC LIST OF SPECIES.

##### Family SUIDÆ.

##### SUS BABI Miller?

1906. *Sus babi* MILLER, Proc. U. S. Nat. Mus., XXX, 1906, p. 752.

The two specimens procured, the skin and skull of a young male (No. 140958) and the skull of an adult female (No. 140959), are, as already stated in the original description of *Sus babi*, not sufficient to make possible a definite identification of the Engano pig. Doctor Abbott writes of the animal as follows:

"Pigs are very common in Engano, but are never kept tame. They are said to be descended from animals which swam ashore from a stranded ship, perhaps twenty-five years ago. The natives say that previous to this none existed. One afternoon, while I was on shore, a pig swam off from the mainland bound for Pulo Dua. He had nearly reached the schooner's anchorage when the noise made by the crew frightened him and he turned back to the main island. There were no boats by the schooner at the time or the animal could readily have been caught."

##### Family VIVERRIDÆ.

##### PARADOXURUS HERMAPHRODITUS (Pallas).

1894. *Paradoxurus hermaphroditus* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 105. April 10, 1894.

An adult female (No. 141026) was taken on the main island, November 10, 1904. It closely resembles Sumatran specimens. Mammæ, 4. Weight, 2.27 kg. Measurements: Head and body, 495 mm.; tail, 410; hind foot, 83; skull, upper length, 88; condylobasilar length, 95.6; zygomatic breadth, 52.8.

"Musangs were very common, and their droppings could be seen everywhere in the paths. I did not succeed in trapping any, however, and the one specimen taken was brought in by natives. It is doubtless an introduced species. There were a few on Pulo Dua."

One specimen was taken by Modigliani on Pulo Dua.

## Family MURIDÆ.

## MUS near RATTUS.

1894. *Mus rattus* var. THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 109. April 10, 1894.

Four specimens were taken on Pulo Dua and a fifth on the main island. Doctor Abbott remarks that rats were common about the houses but were scarce in the forest.

Modigliani collected one specimen on Pulo Dua.

## MUS ENGANUS, new species.

1894. ?*Mus* sp. THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 110, April 10, 1894.

*Type*.—Adult male (skin and skull). No. 140976, U.S.N.M. Collected on Engano Island, December 4, 1904, by Dr. W. L. Abbott. Original number, 3823.

*Characters*.—General appearance not unlike a light-colored *Mus norvegicus*, but tail longer than head and body, and fur of a soft, almost silky texture, except along middle of back, where it becomes somewhat harsh. Skull with rostrum fully one-half deeper and broader than in *Mus norvegicus*; maxillary teeth with lateral cusps relatively more developed. Tail with 12 rings to the centimeter at middle.

*Fur and color*.—The fur is of a soft, almost silky texture, though without trace of woolliness. On sides the hairs are about 12 mm. long. On back the mass of the fur increases to about 18 mm. in length, at the same time becoming somewhat harsh in texture, while there is an evident sprinkling of slender, grooved bristles 35 mm. long. These bristles are so slender as to resemble ordinary hairs, but their grooved character can be detected with a lens. Whiskers long and soft, reaching to axillæ. Hairs on tail slightly exceeding length of scales, but becoming somewhat longer near tip, though without forming pencil.

Underparts pale smoke-gray, the hairs becoming darker (about gray No. 6) basally. On sides and cheeks the gray becomes suffused with a dull, pale, ochraceous-buff, this decidedly predominating on back, crown, and face, where it is further darkened by the sprinkling of black bristle hairs. Muzzle washed with hair-brown. Feet scantily sprinkled with fine, light-gray hairs. Tail uniform, dark-brown throughout.

*Skull and teeth*.—In general appearance the skull somewhat resembles that of a large *Mus norvegicus*, but it is at once distinguishable by the greatly increased breadth and depth of the rostrum, each of which is decidedly more than half the length of nasals. The nasals are abruptly truncated in front, a character which adds to the peculiar

appearance of the rostrum. Anterior zygomatic root essentially as in *Mus norvegicus*. Nasals terminating posteriorly about in line with premaxillaries. Audital bullæ and entire ventral aspect of skull (broad rostrum excepted) as in *Mus norvegicus*.

The maxillary teeth differ from those of typical *Mus* in the greater development and more evident demarkation of the lateral series of cusps, both outer and inner. There are, however, no unusual elements in the teeth. The mandibular teeth show no appreciable peculiarities.

*Measurements*.—Total length, 485 mm.; head and body, 228; tail, 257; hind foot, 46 (43); ear from meatus, 19; ear from crown, 13; width of ear, 14.4; skull, upper length, 44.6; condylobasal length, 44; basilar length, 38; palatilar length, 22.8; diastema, 13; length of nasals, 15.2; greatest breadth of nasals, 6; greatest breadth of rostrum, 8.4; least depth of rostrum, 9; zygomatic breadth, 23.4; interorbital constriction, 7; breadth of brain case above roots of zygomatics, 17.4; mastoid breadth, 16.6; maxillary tooth row (alveoli), 8.6; mandible, 27; mandibular tooth row (alveoli) 8.

*Specimens examined*.—One, the type.

*Remarks*.—For the sake of convenience, I have compared this remarkably distinct species with *Mus norvegicus*, an animal with which it probably has no near relationship. The strong development of the lateral cusps of the maxillary teeth removes it from the typical group of *Mus*, but in the present unsatisfactory state of this genus I am not able to decide as to the forms with which it should be placed.

#### PTEROPUS ENGANUS, new species.

1894. *Pteropus hypomelanus* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 106, April 10, 1894.

*Type*.—Adult male (skin and skull), No. 140966, U.S.N.M. Collected on Pulo Dua, Engano, November 4, 1904, by Dr. W. L. Abbott. Original number, 3774.

*Characters*.—Similar to *Pteropus lepidus* Miller, but smaller, and with black darker than the mantle. Larger than *Pteropus hypomelanus* Temminck.

*Color*.—Type: Back a rather dark hair-brown, darkest and clearest anteriorly, though everywhere somewhat lightened by a sprinkling of silvery hairs, and along edges of membranes a little suffused with ochraceous-buff. Mantle pale tawny-ochraceous, darkening on sides of neck through hazel to chestnut, this in turn blackening on under-side of neck. Behind this blackish area the underparts are much like back, except that the brown is darker, the silvery hairs are absent, and the lighter suffusion is more nearly hazel. Head a grizzled drabby gray, many of the hairs with noticeable silvery reflections in certain lights.

. *Skull and teeth*.—The skull and teeth resemble those of *Pteropus lepidus*, differing merely in their generally smaller size. Mandible noticeably more slender than in the related species.

*Measurements*.—For external measurements see table, page 824. Cranial measurements of type: upper length, 61.2 mm.; condylobasal length, 60; basilar length, 55; median palate length, 30.6; palatal breadth between anterior molars, 12; zygomatic breadth, 34; least interorbital breadth, 8.4; constriction behind postorbital processes, 7.4; breadth between tips of postorbital processes, 25.6; greatest breadth of brain case above roots of zygomata, 22; greatest depth of brain case, 17; occipital depth, 11.8; depth of rostrum at middle of diastema, 7.8; mandible, 48.8; maxillary tooth row exclusive of incisors (alveoli) 23.4; mandibular tooth row exclusive of incisors (alveoli), 26.6.

*Specimens examined*.—Thirty-two from Engano, Pulo Dua, and Pulo Mirbau.

*Remarks*.—The color phase represented in the type occurs in the majority of the specimens. In some, however, the silvery hairs on the back predominate so as to make the color a light gray, while in others the ochraceous-buff wash is so increased as to conceal the brown. The gray phase and the buff phase are connected with the normal dark phase by intermediates of every degree, but the series of skins show no direct intergradation between the two pale extremes.

This animal appears to be not closely allied to *Pteropus lepidus* of the South China Sea islands, but is readily distinguishable by its smaller size and invariably light mantle. It is undoubtedly larger than *Pteropus hypomelanus*, the shortest forearm in the series measuring 122 mm., while that of the type of the Ternate species measures, according to Dobson, 119 mm.

#### PTEROPUS MODIGLIANII Thomas.

1894. *Pterophus modiglianii* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 106. April 10, 1894.

Twelve specimens were taken by Doctor Abbott, mostly on the main island. Two are recorded by Thomas in the original description.

In color the shins are very uniform, the only variation being a slight tendency in some specimens for the rump and flanks to become suffused with dull ochraceous. While this species is rather closely related to *Pteropus natalis*, of Christmas Island, I fail to discover any strong resemblance between it and the much larger, short-haired *Pteropus nicobaricus*, to which it has been compared.

Regarding the occurrence of the two species of *Pteropus*, Doctor Abbott writes:

“The rufous-naped species [*enganus*] was very common on Pulo Dua and was generally found hanging and feeding on cocoanut trees. The black one [*modiglianii*] was not numerous on Pulo Dua. On the main

island it appeared to be the more numerous. It generally was found feeding on wild fruit, and did not frequent the cocoanut trees."

*Measurements of Pteropus.*

| Name.                        | Locality.                  | Number. | Sex.      | Head and body. | Tibia. | Foot. | Forearm. | Thumb. | Second finger. | Third finger. | Fourth finger. | Fifth finger. |
|------------------------------|----------------------------|---------|-----------|----------------|--------|-------|----------|--------|----------------|---------------|----------------|---------------|
| <i>Pteropus enganus.</i>     | Engano .....               | 140961  | Male ...  | 203            | 58.0   | 42.3  | 128.0    | 56.8   | 96.0           | 245           | 195            | 175           |
| Do .....                     | do .....                   | 140965  | do .....  | 202            | 56.0   | 41.4  | 126.0    | 55.0   | 94.4           | 235           | 189            | 166           |
| Do .....                     | do .....                   | 140966  | do .....  | 203            | 53.0   | 41.0  | 125.0    | 57.0   | 93.0           | 238           | 191            | 167           |
| Do .....                     | do .....                   | 140964  | Female .. | 201            | 51.0   | 39.0  | 123.0    | 52.0   | 94.0           | 231           | 178            | 162           |
| Do .....                     | do .....                   | 140973  | do .....  | 207            | 53.0   | 39.0  | 124.6    | 53.6   | 98.6           | 238           | 186            | 172           |
| Do .....                     | do .....                   | 140987  | do .....  | 207            | 51.0   | 43.0  | 126.0    | 48.8   | 90.4           | 233           | 187            | 169           |
| <i>Pteropus lepidus.</i>     | Big Tambe-<br>lian Island. | 101649  | Male ...  | 229            | 68.0   | 43.0  | 135.0    | 61.0   | 99.0           | 260           | 205            | 184           |
| Do .....                     | do .....                   | 101651  | do .....  | 222            | 65.0   | 43.0  | 136.0    | 62.0   | 100.0          | 260           | 207            | 185           |
| Do .....                     | do .....                   | 101650  | Female .. | 216            | 57.0   | 41.0  | 128.0    | 59.0   | 96.0           | 255           | 200            | 177           |
| Do .....                     | Saddle Island.             | 101670  | do .....  | 222            | 58.0   | 40.0  | 133.0    | 61.0   | 103.0          | 256           | 200            | 175           |
| Do .....                     | Pulo Laut ..               | 104740  | Male ...  | 230            | 61.0   | 44.0  | 141.0    | 60.0   | 103.4          | 270           | 215            | 193           |
| Do .....                     | do .....                   | 104741  | Female .. | 215            | 59.0   | 42.6  | 137.0    | 58.8   | 104.6          | 263           | 206            | 182           |
| <i>Pteropus modiglianii.</i> | Engano .....               | 140977  | Male ...  | 240            | 62.4   | 45.0  | 139.0    | 62.4   | 105.0          | 262           | 207            | 186           |
| Do .....                     | do .....                   | 140978  | do .....  | 242            | 63.4   | 46.0  | .....    | 59.0   | 105.4          | 267           | 210            | 187           |
| Do .....                     | do .....                   | 140985  | do .....  | 215            | 63.0   | 44.0  | 135.0    | 50.0   | 100.0          | 258           | 205            | 180           |
| Do .....                     | do .....                   | 140979  | Female .. | 220            | 58.0   | 39.0  | 134.0    | 54.6   | 98.6           | 257           | 202            | 194           |
| Do .....                     | do .....                   | 140980  | do .....  | 222            | 61.4   | 46.4  | .....    | 58.6   | 101.0          | 268           | 204            | 177           |
| Do .....                     | do .....                   | 140984  | do .....  | 225            | 58.4   | 48.4  | 139.0    | 60.4   | 109.0          | 276           | 209            | 186           |

<sup>a</sup> Type.

**ROUSETTUS AMPLEXICAUDATUS (Geoffroy).**

1894. *Xantharpyia amplexicaudata* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 108. April 10, 1894.

Recorded by Thomas, but not taken by Doctor Abbott.

**Family RHINOLOPHIDÆ.**

**RHINOLOPHUS CALYPSO (Andersen).**

1894. *Rhinolophus affinis* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 108. April 10, 1894.

1905. *Rhinolophus calypso* ANDERSEN, Proc. Zool. Soc. London, 1905, II, p. 134. October 17, 1905.

Collected by Modigliani in 1891. Seven taken by Doctor Abbott.

**HIPPOSIDEROS DIADEMA (Geoffroy).**

1894. *Hipposiderus diadema* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 108. April 10, 1894.

**HIPPOSIDEROS GALERITUS (Cantor).**

1894. *Hipposiderus galeritus* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 108. April 10, 1894.

**HIPPOSIDEROS BICOLOR (Temminck).**

1894. *Hipposiderus bicolor* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 108. April 10, 1894.

These three bats were taken by Modigliani, but were not observed by Doctor Abbott.

## Family VESPERTILIONIDÆ.

## PIPISTRELLUS IMBRICATUS (Horsfield).

1894. *Vesperugo imbricatus* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova (2), XIV, p. 108. April 10, 1894.

Two specimens (females, Nos. 141018 and 141019) taken on Pulo Dua November 16, 1904, are evidently referable to the species recorded by Thomas.

## KERIVOULA ENGANA, new species.

*Type*.—Adult male (in alcohol), No. 141020, U.S.N.M. Collected on Pulo Dua, Engano, November 3, 1904, by Dr. W. L. Abbott. Original number, 3766.

*Characters*.—Like *Kerivoula hardwickii*, but larger.

*Color*.—After a year's immersion in alcohol the general color is very nearly broccoli-brown above, becoming yellower on head and darkening about to wood-brown below, the hairs everywhere a dark hair-brown on basal half, those of the back with a broad buffy-gray area between this and the broccoli-brown tips; ears and membranes dark brown.

*Skull and teeth*.—The skull and teeth do not appear to differ appreciably from those of *Kerivoula hardwickii* except in their noticeably greater size.

*Measurements*.—Measurements of the two specimens collected (those of the type first): Total length, 85 (85) mm.; head and body, 43 (41); tail, 42 (44); tibia, 17.6 (17.4); foot, 8 (7.6); forearm 33, (34.4); thumb, 8 (7.6); second finger, 35 (37); third finger, 70 (74); fourth finger, 51 (56); fifth finger, 48 (52); ear from meatus, 13 (14.6); ear from crown, 11.6 (12.4); width of ear, 13 (12); skull, greatest length, 14.6; condylobasal length, 13.6; palatal length, 7.8; zygomatic breadth, 9; breadth of braincase, 7.4; height of braincase through audital bulla, 6.6.

*Specimens examined*.—Two, both from Pulo Dua.

*Remarks*.—The Engano *Kerivoula* is readily distinguishable from *K. hardwickii* of Java by its generally larger size, a character particularly evident in the skull and foot. The color is throughout yellower than in the Javan form.

## Family EMBALLONURIDÆ.

## EMBALLONURA SEMICAUDATA (Peale).

1894. *Emballonura semicaudata* THOMAS, Ann. Mus. Civ. di Stor. Nat. di Genova, (2) XIV, p. 109, April 10, 1894.

Recorded by Thomas, but not taken by Doctor Abbott. It seems improbable that this animal is the same as the true *Emballonura semicaudata* of Samoa.



# THREE NEW FUNGIÆ, WITH A DESCRIPTION OF A SPECIMEN OF *FUNGIA GRANULOSA* KLUNZINGER AND A NOTE ON A SPECIMEN OF *FUNGIA CONCINNA* VERRILL.

By T. WAYLAND VAUGHAN,

Custodian of Madreporarian Corals, U. S. National Museum; Geologist, U. S. Geological Survey.

In determining the species of corals belonging to the genus *Fungia* in the United States National Museum, I discovered the three forms, described as new species, a specimen of *F. granulosa* Klunzinger and one of *F. concinna* Verrill that seems worth a notice. The first considered new is a fossil species collected by Prof. Raphael Pumpelly in Toshibetz Valley, Island of Yesso, Japan. Of the two recent forms, *F. samboangensis* and *F. madagascarensis*, the first belongs to Professor Döderlein's group of *F. repanda*; the second to his group of *F. fungites*. Without a very large series for comparison, it is not possible to assert positively that these forms are not variations of previously described species. *F. samboangensis* is closely related to *F. repanda* Dana; *F. madagascarensis* belongs in the group of *F. fungites*, but is separated principally by the character of the basal spines. I have not been able to identify these specimens by comparison with the material in the United States National Museum nor by a study of the literature, therefore I feel positive that they are undescribed forms, and think that they should be recorded, even if subsequent work should prove that they are not entitled to specific recognition.

Fossil from Japan, group of *F. PATELLA* (Ellis and Solander).

## FUNGIA JAPONICA, new species.

Plate LXVII.

Corallum fungiform, deformed (*Diaseris* form), free, without trace of detachment scar. Base (and wall) concave upward, more or less corrugated. The deformity resembles that found in *Diaseris* and *Diafungia*.

| Dimensions.                     | Greater diameter at base. | Lesser diameter at base. | Height. | Depth of calice. |
|---------------------------------|---------------------------|--------------------------|---------|------------------|
|                                 | mm.                       | mm.                      | mm.     | mm.              |
| Specimen No. 1 (type) .....     | 24                        | 22.5                     | 17.5    | About 9.         |
| Specimen No. 2 (paratype) ..... | 20                        | 15.5                     | 11      | About 5.5.       |

The base, besides possessing corrugations, has several deep sinuses, and numerous fine, not prominent, granulated costæ, which usually alternate rather regularly in size, and correspond to all septa. Toward the central portion of the base they are resolved into a great number of granulations without apparent definite arrangement. The wall over the greater portion of the base appears solid, but rather often near the periphery synapticala may be seen joining the septa together. In places the wall is clearly synapticalate. The appearance is that the wall is at first synapticalate and later becomes secondarily thickened so as to be imperforate almost throughout.

The septa are extremely numerous, thin, and very much crowded, at the edge of the corallum equal or subequal, above the edge and near the fossa unequal. In specimen No. 1 there are ten or twelve larger septa, with about twenty or more smaller intervening septa. The cycles are not distinctly differentiated, but apparently the arrangement is between six and seven cycles, with the members of the first and second cycles of the same size. Those of the third cycle are shorter; those of the fourth are shorter than those of the third. The members of the fifth cycle are shorter than those of the fourth. In places it could be seen that the two outer septa of the sixth cycle in a quarter system (that is, a septum of the sixth cycle standing next to the one of the first cycle and the one next the member of the third cycle in the same quarter system) are prolonged beyond the inner end of the included member of the fourth cycle and equal in length the member of the third cycle. The members of the sixth cycle seem always to be longer than those of the fifth. The seventh cycle is not complete; they appear to be short, but often it does not seem possible to distinguish between the members of the sixth and seventh cycles, so that sometimes an outer septum of the seventh may be prolonged and combined with one of the sixth for the inclusion of one of the fifth.

The septal margins are very finely dentate. Laterally the septa are striate, the striæ usually opposed in pairs, with granulations arranged along their courses. Each dentation on the septal margins corresponds in position to the termination of a pair of striæ. Septal perforations are numerous in the younger septa, especially near the margin; they occur between and sometimes in the courses of the septal trabeculæ, and are not perfectly regular in occurrence. The older septa, except near the margin and inner termination, are usually imperforate.

The calicular fossa is deep, extending almost to the base of the corallum, and is narrow. There is no columella. A considerable number of septa meet in the bottom of the fossa.

*Locality.*—Toshibetzu Valley, Yesso, Japan. B. Pumpelly, collector.

*Geologic horizon.*—Tertiary; nothing more definite known.

*Type.*—Cat. No. 154426, U.S.N.M.

## RECENT SPECIES.

Group of *F. REPANDA* Dana.**FUNGIA SAMBOANGENSIS**, new species.

Plate LXVIII and Plate LXIX, fig. 1; Plate LXXIV, fig. 1.

Corallum rather large, circular in outline, slightly arched, base gently concave. Wall perforate, numerous slits between the costæ to near the center, around which is an imperforate area about 25 mm. in diameter. Costæ rather fine, not greatly differentiated in size. Every fourth or sixth may be somewhat thicker and more prominent than those intervening. *All the costæ are spinose*, the spines smaller near the edge, where they are of only moderate size, or rather small, and in a single series. Toward the center they become larger and the distribution is not quite so regular as near the periphery. On the central imperforate area the spines are again somewhat smaller and are distributed irregularly. The shanks of the spines are smooth or with only occasional granulations; the tips are rounded, blunt, often though not always swollen, and *are granulated*.

*Septa unequal*, even on the periphery, where usually there are at least three different heights and three different thicknesses; all septa, even the thicker, are thin, the smallest very thin. On the upper surface they are very unequal, of three or four different heights. About eighteen septa reach the axial fossa. The inner edge of these are prominent and fall steeply to the bottom of the fossa. Between each pair of these longest septa are from one to three shorter ones of practically equal height. Then there are several lower, thinner septa, scarcely half the height of the taller, between each pair of taller ones. Septal margins serrately dentate. On the larger septa the serrations are coarser—in fact, decidedly coarse—near the periphery; become smaller and ultimately obsolete toward the fossa. Near the periphery there are five or six dentations to the centimeter; nearer the fossa, seven or eight. *There are no tentacular lobes*. The septal faces show low, broad ridges corresponding to the serrations; the whole of the septal are covered with minute granulations; near the edges are minute wavy lines running parallel to the margins. The synapticula are distinctly visible from above.

Columella distinctly developed, composed of very delicate, spongy tissue.

*Dimensions*.—Length, 130 mm.; width, 130 mm.; height, 44 mm.

*Locality*.—Samboanga, Philippine Islands. J. B. Steere, collector.

*Type*.—Cat. No. 21, 139, U.S.N.M.

*Affinities*.—This coral belongs to Professor Döderlein's "*Repanda* Group,"<sup>a</sup> and is near *F. concinna* Verrill and *F. repanda* Dana. How-

<sup>a</sup> Die Korallengattung *Fungia*, p. 105.

ever, it does not seem possible to refer it to any of the previously-described species. The nearly equal ribs separate it from both the species just mentioned. It is, in addition, separated from *F. concinna* by its very perforate wall, the wall in that species being almost solid. I thought the species that I am describing might be *F. serrulata* Verrill,<sup>a</sup> which Döderlein considers a variety of *F. concinna*. According to Professor Verrill's description the specimen from Samboanga can scarcely be his *F. serrulata*, which he describes as having "principal costæ" "and many other finer ones between," and "the [septal] edges irregularly dentate, with small, very acute, unequal teeth." I therefore think *Fungia samboangensis* will stand as a good species.

**FUNGIA GRANULOSA** Klunzinger.

Plates LXX and LXXI; Plate LXXIV, fig. 2.

1879. *Fungia granulosa* KLUNZINGER, Korallenth. Rot. Meer., III, p. 65, pl. VII, fig. 3; pl. VIII, fig. 3.

1902. *Fungia granulosa* DÖDERLEIN, Korallengat. Fungia, p. 108, pl. XI, figs. 1, 1a, 1b.

Description of a specimen in the United States National Museum:

Corallum large, low, irregularly flexed, the length greater than the width; wall with a few slits near the periphery, otherwise solid; costæ of several sizes, one set decidedly thicker and considerably more prominent than the others. These largest costæ are densely granulated, the granulations present on both the sides and the edges. In places they occur in heaps, and may be prolonged into short, comparatively thick spines. The surfaces of the spines minutely granulated. All the costæ are granulated. The smaller ones have regularly beaded edges. Toward the center of the disk all costæ become obsolete. The largest may be subobsolete, and give place to a large, densely granulate central area, in which some of the granulations may form short spines. These granulations are themselves minutely granulate.

Septa on the periphery, excepting the very smallest, subequal; those corresponding to the large costæ slightly more prominent; on the upper surface decidedly unequal, usually about 7 smaller septa between two taller and thicker ones. The courses of the septa slightly sinuous. Septal margins rather finely dentate, about 14 dentations to 1 cm., not always of equal size; on the curves of the outer edges they are finer. The tips of the dentations acute or rounded. Septal faces densely and minutely granulate, minutely wrinkled near the margin. Synapticula not visible from above except where the septa have been broken. No tentacular lobes. Columella very poorly developed, almost absent.

*Dimensions*.—Length, 157 mm.; breadth, 143 mm.; thickness at inner ends of large septa, 28 mm.

<sup>a</sup> Bull. Mus. Comp. Zool., I, 1864, p. 51.

*Locality*.—Unknown.

*Type*.—Cat. No. 110, U.S.N.M., U. S. Expl. Exped. specimen.

*Note*.—I have described and figured the specimen, as the species is rare and not well known. Döderlein had only two specimens.

Group of *F. FUNGITES* (Linnæus).

*FUNGIA MADAGASCARENSIS*, new species.

Plates LXXII and LXXIII; Plate LXXIV, fig. 3.

Corallum large, heavy, strongly arched, base concave, deformed, length exceeds width. Wall perforate, with numerous slits and pits. Costæ of two kinds, spined and without spines. Between each pair of spiniferous costæ are from one to three much thinner and less prominent costæ that do not bear spines. Of the spine-bearing costæ every other or every fourth is usually thicker and somewhat more prominent than the intervening ones. The larger costæ may be as much as 2.5 mm. thick. The spines are tall and thick, the larger ones as much as 2 mm. in diameter near the base and 4.5 mm. in height. Rather often they are compound and are frequently forked at the end. The shanks of the spines are smooth, glabrous, the tips secondarily spinulose. Toward the center the costæ become indistinct. The central area is covered by coarse spines similar to, but smaller than those on the costæ.

Septa, at the periphery unequal or subequal; above they are usually of about three different heights and four or five different thicknesses, the largest septa very thick, as much as 2.5 mm. The others graded in size to the youngest which are thin and closely wedged in between the older septa, they are so crowded that the faces almost touch. All of the septa coarsely dentate, on the larger septa 3 to 5 to 1 cm.; their height 3 to 4.5 mm.; they may terminate as blunt styles, or be irregularly serrate in form. Irregularly developed tentacular lobes present. The septal faces are almost glabrous—to the naked eyes they are, but with a rather high-power hand glass, very minute, low granulations can be discovered. Synapticula can not be seen from above.

Columella apparently absent.

*Dimensions*.—Length, 177 mm.; breadth, 145 mm.; height, 100 mm.; depth of concavity of base, 55 mm.

*Locality*.—Madagascar, R. W. Shufeldt, collector.

*Type*.—Cat. No. 21,141, U.S.N.M.

*Affinities*.—This species belongs in the group with *Fungia fungites*, in spite of the suggestion that it may, because of having costæ without spines, belong with *F. danai*. The costal spines, when they are not double pointed or compound, are typically like those of *F. fungites*; they are subconical with smooth sides, pointed and show a few projecting trabeculæ on the tips, but could not be called granulate. The almost smooth sides of the septa are like those of *F. fungites*.

The very thick septa recall *F. crassilamellata* M. Edwards and Haine, but the septal dentations and costal spines are entirely different. According to Döderlein's Key<sup>a</sup> it is nearest to *F. fungites* var. *dentata* and one would infer the same from his description. None of the specimens figured by Döderlein shows costal spines nearly so large as in the specimen here described. There are several excellent specimens of var. *dentata* in the United States National Museum, including two of Dana's specimens. They differ from the Madagascar specimen especially in the character of the spines.

#### FUNGIA CONCINNA Verrill.

Plate LXIX, fig. 2.

This specimen is interesting as it shows extensive budding from the mouth of the disk. Four larger and two smaller mouths have been formed.

*Locality*.—Papeeti, Tahiti Islands, U. S. Bureau of Fisheries steamer *Albatross*, 1900.

#### EXPLANATION OF THE PLATES.

##### PLATE LXVII.

*Fungia japonica*, new species, figs. 1, 2, 3, three views, side, calicular and basal, respectively, of the same specimen. Height, 18 mm.; width, 27.5 mm.; fig. 4, face of a septum enlarged, length of septum 6.5 mm.

##### PLATE LXVIII.

*Fungia samboangensis*, new species, calicular view of the type, natural size.

##### PLATE LXIX.

Fig. 1, *Fungia samboangensis*, new species, basal view, natural size.  
2, *Fungia concinna* Verrill, calicular view, natural size.

##### PLATE LXX.

*Fungia granulosa* Klunzinger, calicular view, natural size.

##### PLATE LXXI.

*Fungia granulosa* Klunzinger, basal view, natural size.

##### PLATE LXXII.

*Fungia madagascarensis*, new species, calicular view, natural size.

##### PLATE LXXIII.

*Fungia madagascarensis*, new species, basal view, natural size.

##### PLATE LXXIV.

Septal margins enlarged twice: Fig. 1, *Fungia samboangensis*; fig. 2, *Fungia granulosa*; fig. 3, *Fungia madagascarensis*.

<sup>a</sup>Die Korallengattung *Fungia*, p. 147.



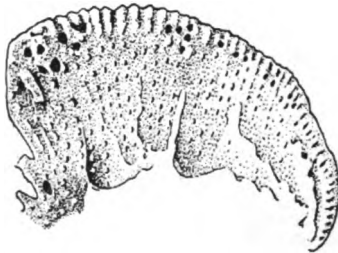
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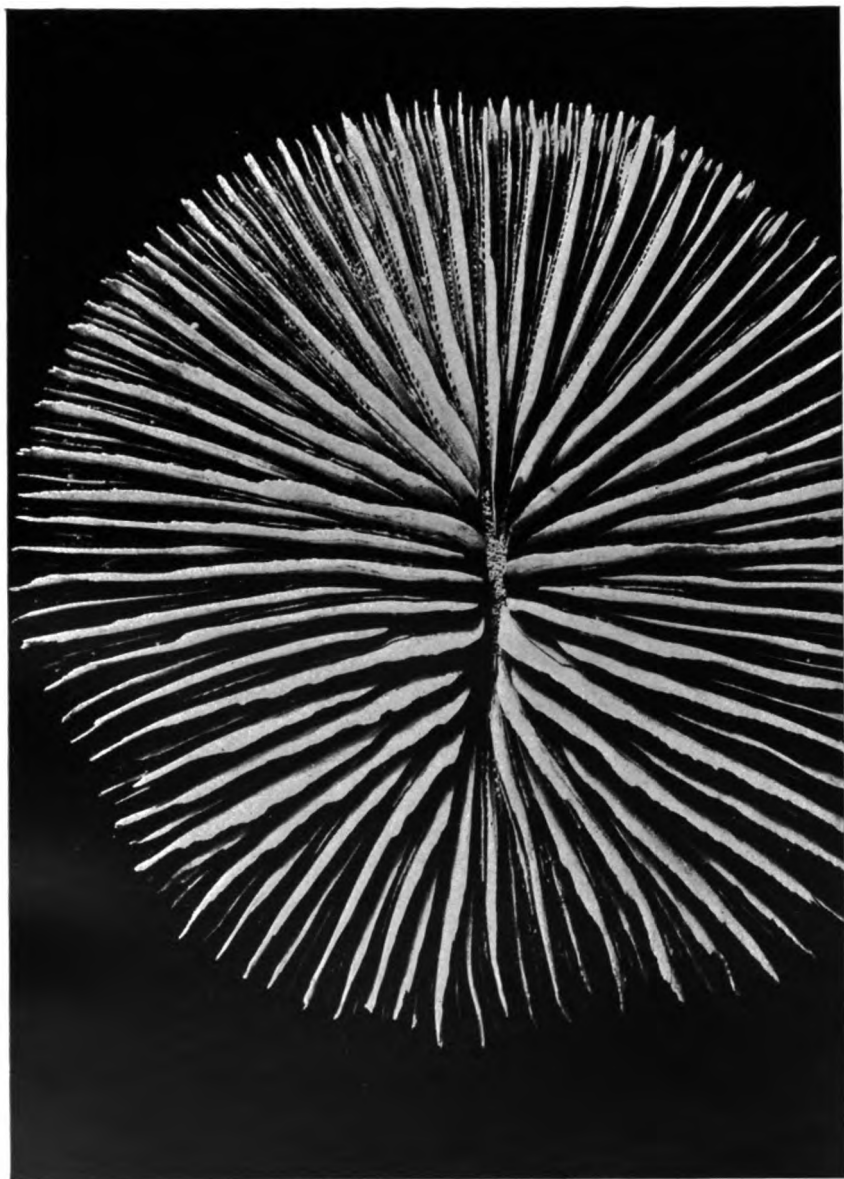


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**FUNGIA JAPONICA, NEW SPECIES.**

FOR EXPLANATION OF PLATE SEE PAGE 832.

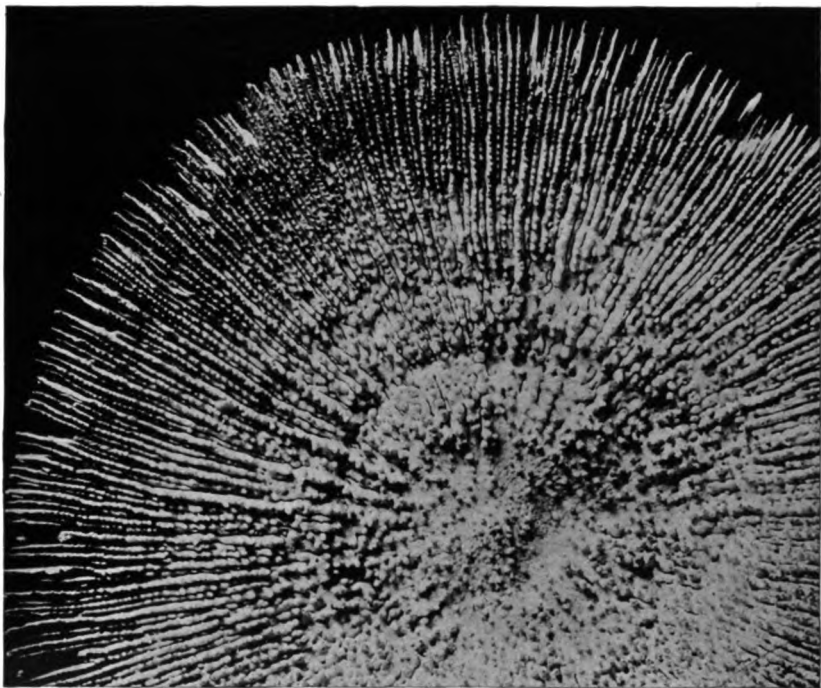




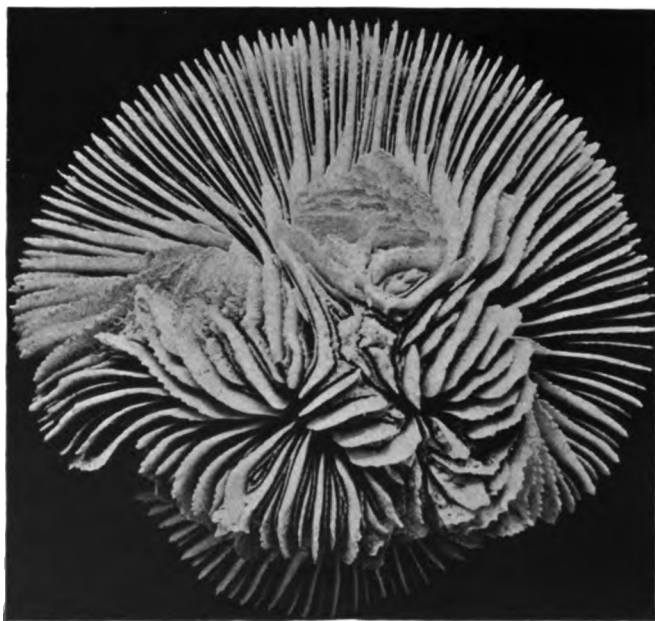
**FUNGIA SAMBOANGENSIS, NEW SPECIES.**

FOR EXPLANATION OF PLATE SEE PAGE 832.





1



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1. *FUNGIA SAMBOANGENSIS*. 2. *FUNGIA CONCINNA*.

FOR EXPLANATION OF PLATE SEE PAGE 832.

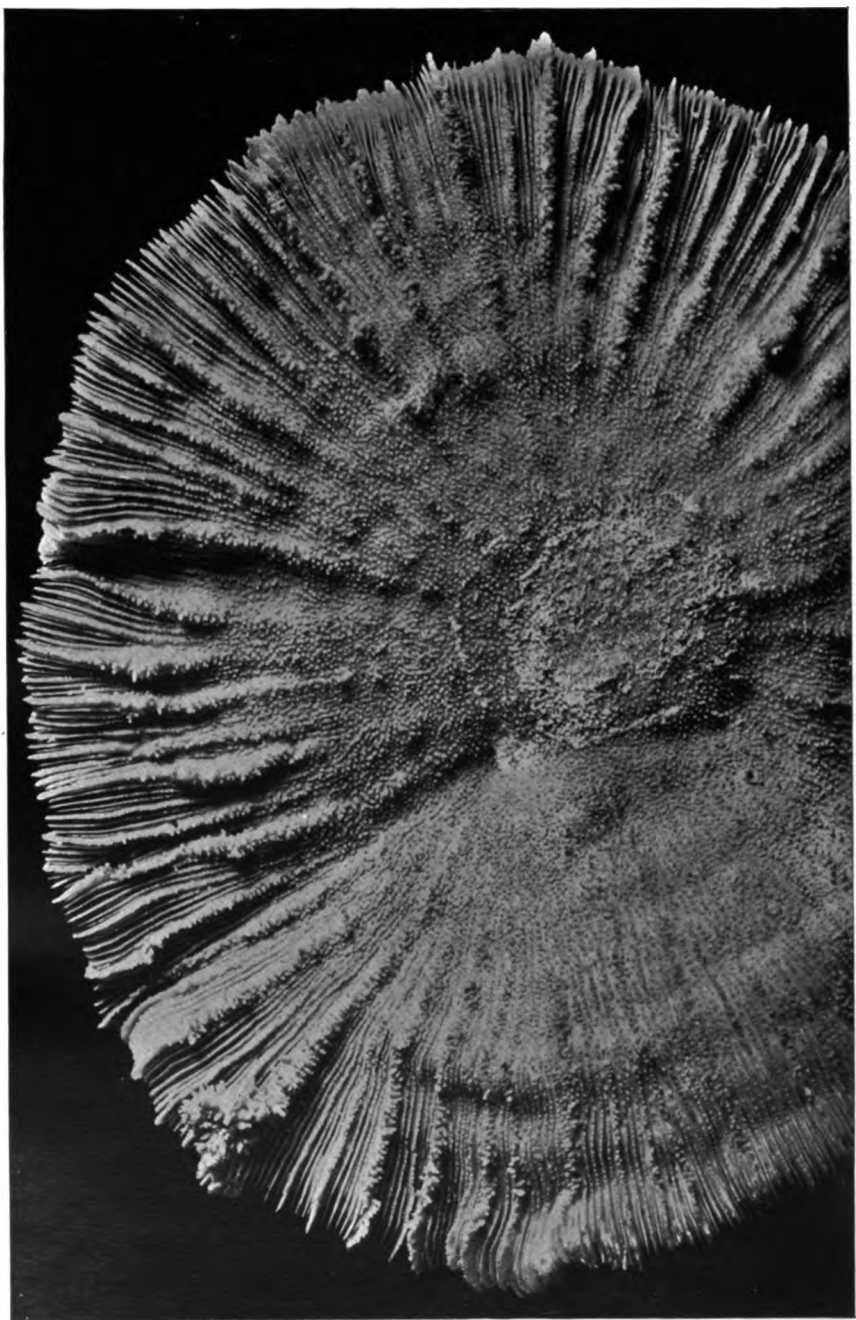




**FUNGIA GRANULOSA KLUNZINGER.**

FOR EXPLANATION OF PLATE SEE PAGE 832.

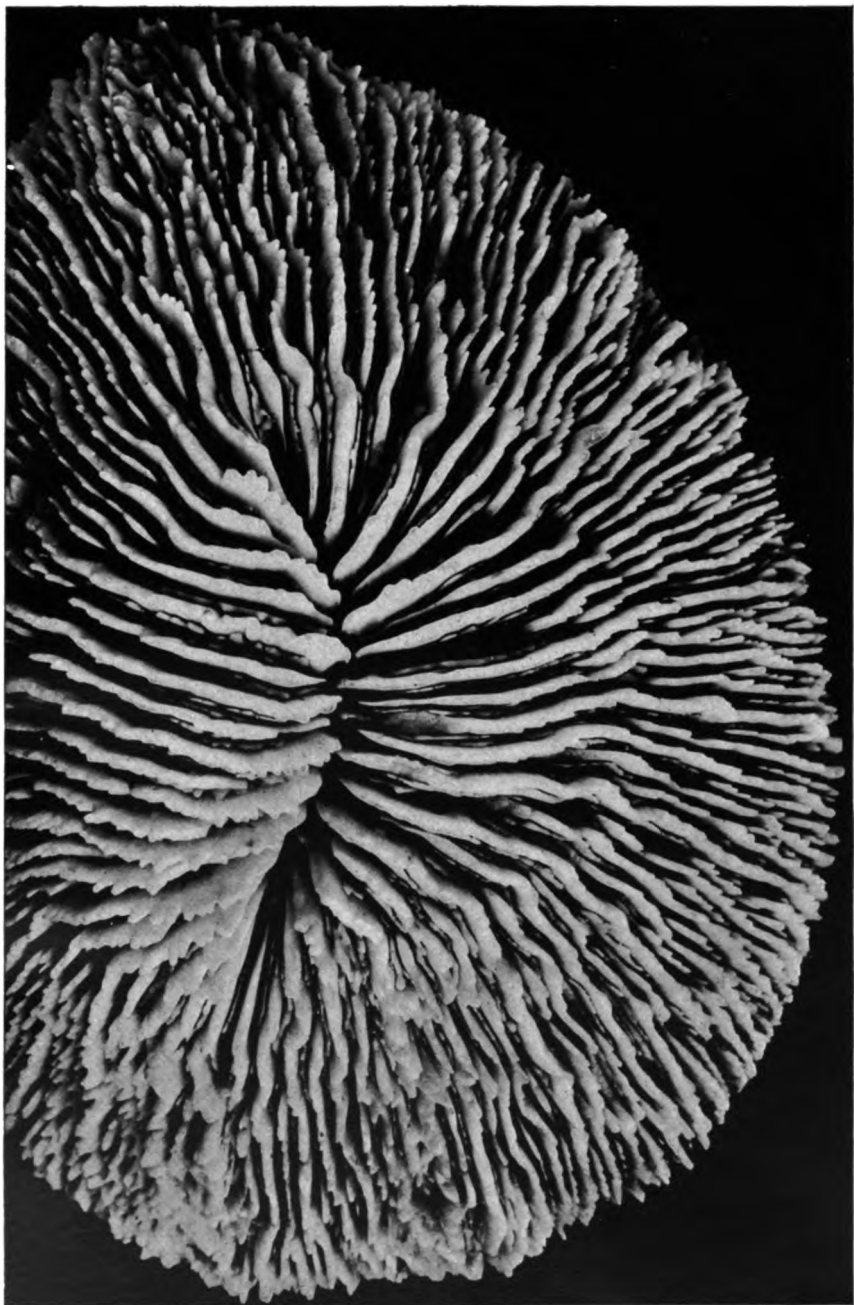




**FUNGIA GRANULOSA KLUNZINGER.**

FOR EXPLANATION OF PLATE SEE PAGE 832.

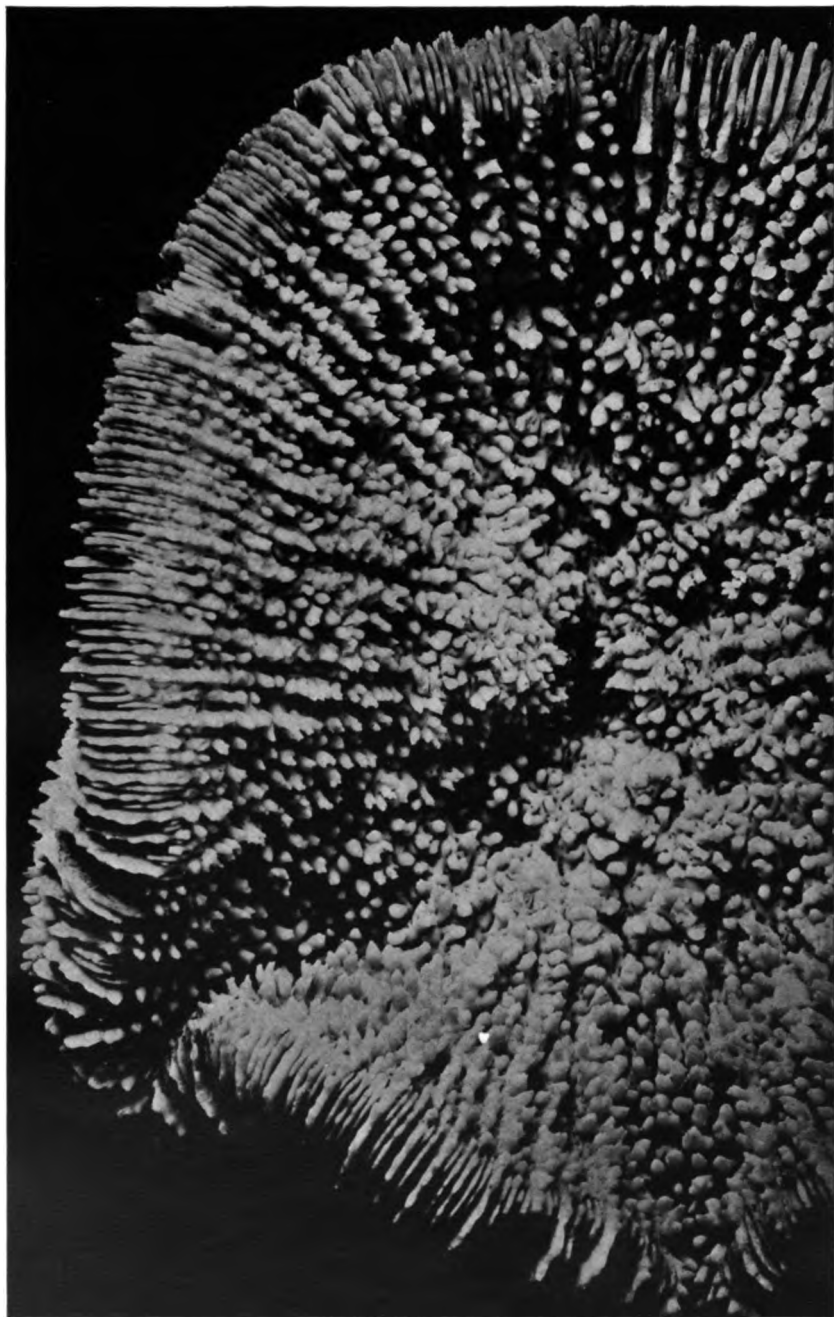




*FUNGIA MADAGASCARENSIS*, NEW SPECIES.

FOR EXPLANATION OF PLATE SEE PAGE 832.

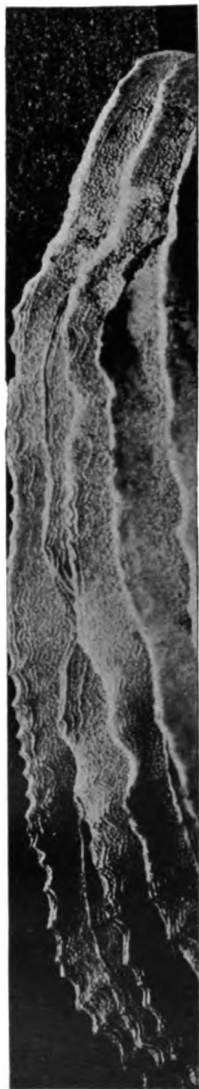




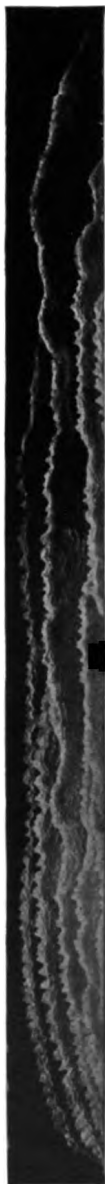
**FUNGIA MADAGASCARENSIS, NEW SPECIES.**

FOR EXPLANATION OF PLATE SEE PAGE 832.

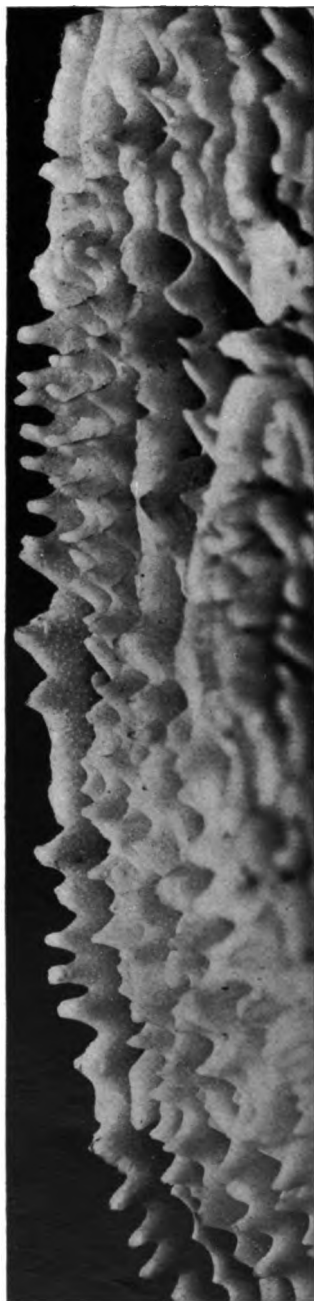




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1. FUNGIA SAMBOANGENSIS. 2. FUNGIA GRANULOSA. 3. FUNGIA MADAGASCARENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 832.



ON A SPECIES OF LOACH; MISGURNUS DECEMCIR-  
ROSUS (BASILEWSKY) FROM NORTHERN CHINA.

By DAVID STARR JORDAN and JOHN OTTERBEIN SNYDER,  
*Of Stanford University, California.*

In a recent paper on the *Cobiditæ*, or Loaches of Japan,<sup>a</sup> Messrs. Jordan and Fowler have described the common Japanese species of *Misgurnus*, under the name of *Misgurnus anguillicaudatus* (Cantor), and have referred most of the nominal species of China to the synonymy of this species.

The examination of the specimens collected by Dr. Noah Fields Drake, at Tientsin, recorded by Professor James F. Abbott,<sup>b</sup> shows that these belong to a species quite different from the Japanese. This seems to be the one described by Basilewsky from near Peking, under the name of *Cobitis decemcirrosus*.

The original types of *Cobitis anguillicaudata* Cantor came from Chusan. These are in the British Museum where they have been examined by Mr. C. Tate Regan. Mr. Regan writes: "In three of Cantor's specimens (130-140 mm.), I count 136 to 145 scales; longest dorsal ray, about  $\frac{3}{4}$  length of head; length of head, about 6; length of caudal peduncle, 6 to  $5\frac{1}{2}$  times in that of the fish."

These specimens agree in these respects with the ordinary Japanese species, which has been described by Jordan and Fowler as *Misgurnus anguillicaudatus*, and which seems to be entitled to this name.

The two species before us may be thus distinguished:

- a. Scale relatively large, about 112 (105 to 118) in a lateral series; body plump, the depth  $6\frac{1}{2}$  to  $6\frac{3}{4}$  in body; head,  $6\frac{1}{4}$  to  $7\frac{1}{4}$  in length; barbels long, the longest  $1\frac{1}{4}$  to  $2\frac{3}{4}$  in head; eye, 2 to 3 in snout; color, relatively plain, the stripes and spots not very distinct. Streams of northeastern China ..... *decemcirrosus* 1
- aa. Scales relatively small, about 148 (143 to 154) in lateral series; body slender, the depth  $6\frac{3}{4}$  to 8 in length; head,  $6\frac{1}{2}$  to  $6\frac{3}{4}$  in length; barbels short, the longest  $3\frac{1}{4}$  to  $4\frac{1}{4}$  in head; eye,  $2\frac{3}{4}$  to 3 in snout; coloration rather brighter, but very variable; the body with dark lateral shades and more or less numerous small black spots. Streams of Japan, common everywhere in Hondo, Shikoku, and Kiusiu; also in southeastern China, Chusan, Shanghai, etc ..... *anguillicaudatus* 2

<sup>a</sup> Proc. U. S. Nat. Mus., XXVI, 1903, pp. 766 to 774.

<sup>b</sup> Idem, XXIII, 1901, p. 483.

## 1. MISGURNUS DECEMCIRROSUS (Basilewsky).

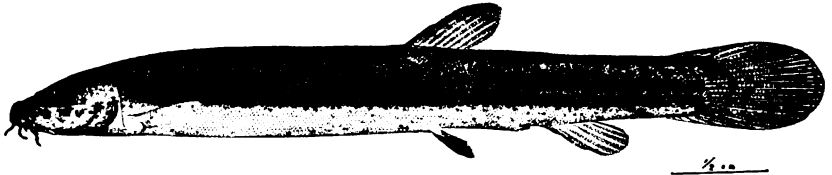
*Cobitis decemcirrosus* BASILEWSKY, Mem. Soc. Nat. Moscow, 1855, p. 239, pl. vii, (tolerable figure); near Peking.

*Misgurnus anguillicaudatus* ABBOTT, Proc. U. S. Nat. Mus., XXIII, 1901, p. 489; Tientsin.

Of this species we have seen Abbott's specimens, 47 in number, from 50 to 250 mm. in length.

2. MISGURNUS ANGUILLICAUDATUS (Cantor).<sup>a</sup>

Of this species we have many specimens from various parts of Japan. The specimen figured in this paper has a curious history. It was found alive in the bilge water of a coal steamer, the *Acapulco*, on its arrival in San Francisco from Nanaimo in British Columbia. It was



MISGURNUS ANGUILLICAUDATUS.

then kept alive in an aquarium at Stanford University for about a year. Apparently it had been brought alive from Japan by some Japanese laborer and had survived some accident which had thrown it into the hold of the ship. The specimen agrees fully with others from Yodo River at Osaka.

Two specimens from Shanghai seem to belong to this species, although having the head a little longer. Head,  $5\frac{1}{2}$ ,  $6\frac{1}{2}$  in length; depth,  $7\frac{1}{2}$ , 8, D, 138, 141. A specimen from Taihoku in Formosa has the head  $5\frac{1}{2}$  in body; depth,  $6\frac{1}{2}$ ; scales, 135; eye,  $6\frac{1}{2}$  in head,  $2\frac{1}{2}$  in snout; longest barbel,  $2\frac{3}{4}$  in head. This may prove to be a distinct species. It is mentioned by Jordan and Evermann as *Misgurnus anguillicaudatus*.<sup>b</sup>

<sup>a</sup>For synonymy, see Jordan and Fowler, Proc. U. S. Nat. Mus., XXVI, 1903, p. 766.

<sup>b</sup>Proc. U. S. Nat. Mus., XXV, 1902, p. 321.

## DESCRIPTION OF A NEW GENUS AND SPECIES OF FOSSIL SEAL FROM THE MIOCENE OF MARYLAND.

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By FREDERICK W. TRUE,  
*Head Curator, Department of Biology.*

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While engaged in collecting fossils for the United States National Museum from the Miocene cliffs bordering the Chesapeake Bay in Calvert County, Maryland, known as the "Calvert Cliffs," I found a few fossil bones which are unmistakably those of seals. These bones, as I have already remarked in a recent number of *Science*,<sup>a</sup> are, so far as I am aware, the first authentic remains of fossil seals found in America. They consist of a nearly perfect humerus, the radius of a young individual (without epiphyses), a fragment representing the proximal end of the conjoined tibia and fibula, and an imperfect lumbar vertebra. The humerus is light gray in color, but the other bones light brown.

In the same locality with these remains was found a larger humerus, which at first I thought might be that of a seal, but on closer examination it appears to be that of a sirenian, belonging, perhaps, to the *Halitheriidae* and allied to *Metaxytherium*. It is broken and considerably waterworn, so that its original form can not be certainly determined. For that reason, I do not think it necessary to devote any further attention to it in the present connection, though it appears to represent a sirenian type not hitherto found in America. It is figured on Plate LXXVI, fig. 4 (Cat. No. 5360, U.S.N.M., Vert. Paleon.).

The smaller humerus already mentioned, though lacking the head and the extremity of the lesser tuberosity, is so well preserved that its characters are plainly discernible. It obviously represents a species belonging to the family *Phocidae*, and a genus allied to *Phoca*, but is not identical with that genus nor any other existing genus of the family. As a means of individualizing it, I propose to establish for it the new genus *Leptophoca*. The following are the characters as far as can be drawn from the humerus:

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<sup>a</sup> *Science*, n. s., XXII, p. 794, Dec. 15, 1905.

## LEPTOPHOCA, new genus.

An extinct phocine pinniped mammal, having the humerus more slender than in any existing genus of seals. Deltoid ridge well developed and broad at the upper, or proximal, end, but narrowing rapidly below and terminating in a thin edge, which, at a point considerably below the middle of the bone, joins at an obtuse angle the ridge running to the inner edge of the trochea. Lesser tuberosity only moderately developed, the bicipital groove between it and the greater tuberosity very narrow relatively. Entepicondylar foramen present. *Type of the genus.*—*Leptophoca lenis*.

## LEPTOPHOCA LENIS, new species.

Size, as determined from the humerus, about that of *Phoca groenlandica*. (See Plate LXXV, fig. 1.) Least transverse diameter of shaft of humerus less than one-seventh the length. Breadth from entepicondylar foramen to supinator ridge less than one-fourth the length. Internal face of deltoid ridge plane. Root of the lesser tuberosity not forming a strong ridge on the internal face of the shaft.

*Measurements of humerus.*—Total length, 129 mm.; least diameter of shaft, transversely, 17; *ditto*, antero-posteriorly, on exterior side, 27; diameter of shaft at insertion of head, posteriorly, 26; distance from distal end of deltoid ridge to center of trochlea, 58; greatest breadth on line of proximal margin of trochlea, anteriorly, 38; breadth from entepicondylar foramen to supinator ridge, posteriorly, 30; greatest breadth of trochlea, anteriorly, 24; breadth of entepicondylar foramen, 2.5.

*Type-specimen.*—No. 5359, U.S.N.M., Vertebrate Paleontology. Humerus, from Calvert Cliffs, Calvert County, Maryland, between Chesapeake Beach and Plum Point. Collected by F. W. True, June 20, 1905. Plate LXXV, figs. 2-4.

*Leptophoca lenis* was probably about the size of *Phoca groenlandica*. The humerus of the latter, while of almost exactly the same length, is much thicker, and the deltoid ridge, as in all existing seals, is thick distally as well as proximally. The lesser tuberosity is much more massive than in *Leptophoca* and is separated from greater tuberosity by a very wide bicipital groove.

The genus *Monachus*, with which several genera of fossil seals have been compared, differs in that the shaft is quite straight, the bicipital groove wide, and the entepicondylar foramen absent.

On account of Dr. J. A. Allen's careful analysis of the data relating to supposed species of American fossil seals, described or mentioned by Leidy and other paleontologists,<sup>a</sup> it does not seem necessary to consider them in detail in this place. His conclusion, namely, that not a

<sup>a</sup>J. A. Allen, North American Pinnipeds, 1880, pp. 469-476.

single extinct species has been certainly determined, appears, in the light of the evidence, entirely valid.

It is well known that P. J. Van Beneden established several genera and species for remains of fossil pinnipeds found in the Tertiary of Antwerp, Belgium. These are described very fully and accurately figured in the Annals of the Belgium Museum of Natural History.<sup>a</sup>

The genera of Phocidæ are *Mesotaria*, *Palæophoca*, *Callophoca*, *Platyphoca*, *Gryphoca*, *Phocanella*, *Monatherium*, and *Prophoca*. A species of *Phoca*, called *P. vitulinoïdes*, is also described. Taking these in order, the differences from *Leptophoca* which the humerus presents are as follows:

In *Mesotaria* the size is greater than in *L. lenis*, the bicipital groove is strongly developed, and the entepicondylar foramen is absent. In *Palæophoca* the shaft is straight, as in *Monachus*, and the entepicondylar foramen is absent. In *Callophoca* the humerus is massive, with the deltoid ridge short and very strong, and no entepicondylar foramen. In *Platyphoca* the size is large and the form massive, the lesser tuberosity little developed, deltoid ridge short, shaft straight, with the external face convex. In *Gryphoca* the deltoid ridge is very strong and the bicipital groove wide and deep. In *Phocanella* the deltoid ridge is very short and broad. In *Monatherium* the size is large and the form massive; the shaft is straight and the deltoid ridge thick.

The genus *Prophoca* merits more detailed consideration. Under the generic heading, Van Beneden remarks only the following, as regards the humerus: "The humerus has one of the sides of the bicipital groove quite straight and compressed."<sup>b</sup> He places two species in the genus, *P. rousseaui* and *P. proxima*, remarking that they are nearly the same size. It would seem from the figures, however, that the former is much larger than the latter. Of *P. rousseaui*, Van Beneden remarks as follows: "The humerus is distinguished from all the others because it is more robust and straighter, the deltoid ridge is little curved and its internal face is scarcely concave, while in all other seals it presents a deep fossa. The bicipital groove is also less deep and is terminated above by the greater tuberosity, which is very strong and much elevated. The posterior face (of the humerus) is not concave below the neck, as in the other genera."<sup>c</sup> Of *P. proxima*, he remarks: "The humerus is straight, as in the preceding species and differs in that particular from existing species. The head is quite large and the neck little pronounced. The greater tuberosity is abraded, but it does not appear to have had the degree of development nor the height found in the ordinary seals. The deltoid ridge is straight, so that the bicipital

<sup>a</sup>P. J. Van Beneden, Description des Ossements Fossiles des environs d'Anvers, 1re Partie, Pinnipèdes ou Amphithériens, Ann. Mus. Roy. d'Hist. Nat. Belg., I, 1877, texte et planches.

<sup>b</sup>Idem, p. 78.

<sup>c</sup>Idem, p. 79.

groove is shallow and but little curved (*ondulée*). The external face of the ridge is concave as far as the neck. The entepicondylar foramen is perfect. The internal tuberosity is raised into a thin ridge toward the posterior face."<sup>a</sup>

These two species, while they present certain similarities, as indicated by the figures published by Van Beneden,<sup>b</sup> seem to me to differ in so many details, at least as regards the humerus, that they can hardly be considered as belonging in the same genus. The principal resemblance between them is in the flatness of the inner face of the deltoid ridge, or, in other words, the shallowness of the bicipital groove. On the other hand, the two forms, aside from marked disparity in size, present numerous differences. In *P. roussseauti* the humerus is very massive and the profile of the shaft has nearly the same concavity on the two sides, while in *P. proxima* the humerus is slender and the external profile of the shaft nearly straight, and the internal profile is strongly concave. Again, the posterior profile of the shaft is concave in *P. roussseauti* and straight in *P. proxima*. In the former the free margin of the deltoid ridge is thick throughout and bends down gradually to the general surface of the shaft distally, while in *P. proxima* it is thick in upper portion, but diminishes suddenly in breadth at about the middle of its length, forming a distinct thin edge distally. Its distal termination joins the shaft at a sharp angle. The lower portion of the humerus of *P. roussseauti* is wanting, and it is not known, therefore, whether there is an entepicondylar foramen in this species.

On account of the differences above mentioned, I am inclined to consider *P. roussseauti* as the type and only species of the genus *Prophoca*. *P. proxima*, as far as may be judged from Van Beneden's figures, presents the peculiar feature of a thin-edged deltoid ridge, much as in *Leptophoca*, but as it differs in that the shaft of the humerus is straighter and that the concavity below the neck on the posterior face of the shaft is lacking, I am uncertain as to whether it should be referred to that genus. It is a little larger than *L. lenis*.

A considerable number of other species of European fossil seals have been described more or less fully by various authors. The majority of these are not comparable with *Leptophoca*, having been founded on teeth or on bones belonging to parts of the skeleton different from those on which *Leptophoca* is based. Of the two or three in which the humerus is known, the form from Bessarabia described and figured by Nordmann in 1860 under the name of *Phoca maeotica*<sup>c</sup> shows a close affinity to *Leptophoca*. The humerus is almost of equal size, and in its general form and characters and in many details, as judged

<sup>a</sup> Pr. J. Van Beneden, Description des Ossements Fossiles des environs d'Anvers, 1re Partie, Pinnipèdes ou Amphithériens, Ann. Mus. Roy. d'Hist. Nat. Belg., I, 1877, texte et planches, p. 80.

<sup>b</sup> Idem, pl. xviii.

<sup>c</sup> A. Nordmann, Paleontologie Sudrusslands, IV, 1860, pp. 313 and 317, pl. xxiii, figs. 1, 2.

by Nordmann's figures, it presents very close similarity. It appears to differ, however, in that the distance from the distal end of the deltoid ridge to the trochlea is much less than in *L. lenis* and that the transverse breadth of the bone opposite the entepicondylar foramen is considerably less; the external face of the ridge appears to be convex rather than concave. I have no hesitancy in referring *Phoca maeotica* to the genus *Leptophoca*, but it probably represents a species distinct from *L. lenis*.

Other bones from the Calvert Cliffs, Maryland, which are probably, but not certainly, referable to *L. lenis* are figured on Plate LXXVI, figs. 1-3. They consist of the proximal end of the conjoined right tibia and fibula, a lumbar vertebra (last), and the right radius of a young individual. These were collected by me at the same locality as the type of *L. lenis*, and in size and general appearance suggest specific identity.

The fragment of the tibia and fibula resembles the same part in *Phoca grænlandica*, but is somewhat smaller and more slender and delicate. In its general conformation, however, it approaches nearer to *Halichærus*, especially in the position of the proximal end of the fibula, which is on a level with the proximal end of the tibia, and in the convexity of the internal face of the tibia. The anterior and posterior faces of the tibia<sup>a</sup> are very deeply concave, the bone between them being very thin.

The lumbar vertebra lacks the transverse processes and metapophyses and the neural spine, but the neural arch is complete and the anterior zygapophyses. From the shape and position of the portions of the processes remaining, it is probable that the bone is the posterior lumbar. It resembles the same vertebra in *P. grænlandica*, but is considerably smaller, and the anterior zygapophyses are much more concave and are directed upward rather than inward. The median depression of the posterior epiphysis of the centrum is much below the level of the depression of the anterior epiphysis. The radius (right), which is that of a young animal, lacks the head and distal epiphysis. It presents no salient characters, except that the tuberosity is large and is situated high up toward the neck.

The dimensions of the foregoing bones are as follows:

*Tibia and fibula*.—Total length of fragment, 59 mm.; breadth at proximal end, 51; transverse breadth of condyles, 41; antero-posterior breadth of larger condyle, 26; of internal surface of tibia, 21.

*Lumbar vertebra*.—Length of centrum, 33 mm.; breadth of anterior epiphysis, 27; depth of same, 23; vertical height of neural arch, anteriorly, 12.

*Radius*.—Total length (head and epiphysis lacking), 78 mm.; greatest breadth at distal end, 30; at proximal end, 16; least diameter of shaft, 13.

<sup>a</sup>In a seal, as the hind legs are directed backward, these surfaces are actually external and internal in relative position.

The exact position in the Miocene to which *Leptophoca* belongs is a matter of much interest, and, fortunately, some light is thrown on that subject by the fossil shells found in the marl adhering to the type-specimen. These have been identified by Dr. William H. Dall, who kindly took them in hand at my request, as representing *Venus rileyi* and a species of *Crassatellites*. Reference to Prof. George B. Shattuck's article on the Geological and Paleontological Relations of the Maryland Miocene<sup>a</sup> shows that *Venus rileyi* and *Crassatellites melinus* have been found together in the Calvert Cliffs only in zone 10, and at a point 1 mile north of Plum Point; or, in other words, 2 or 3 miles south of the point where the bones of *Leptophoca* were found. While species of *Crassatellites* have been found in other zones of the Calvert Cliffs, *Venus rileyi* appears to occur only in zone 10. It seems highly probable, therefore, that *Leptophoca* belongs to this zone of the Calvert formation. The Calvert formation represents the Lower Miocene, a fact which is of interest because the majority of Van Beneden's genera and species are assigned to the Pliocene. Only *Monatherium* and *Prophoca* are assigned to the Miocene, and even these to the Upper rather than to the Lower Miocene. It is to be noted, however, that the "sable noir" in which *Prophoca* occurs is associated by Van Beneden, on the authority of Nyst, with the Miocene of the Vienna Basin,<sup>b</sup> which formation Zittel places on the Middle Miocene.<sup>b</sup> The Tertiary beds of Bessarabia, in which the remains of Nordmann's *Phoca macrotica*, the nearest relative of *Leptophoca lenis*, were found, are also assigned to the Middle Miocene.

## EXPLANATION OF PLATES.

## PLATE LXXV.

- Fig. 1. Right humerus of *Phoca grælandica*. Anterior view.  
 2. Right humerus of *Leptophoca lenis*. Cat. No. 5359, U.S.N.M. Vert. Paleon. Type. Anterior view.  
 3. The same. Posterior view.  
 4. The same. External view.  
 (All the figures a little less than natural size.)

## PLATE LXXVI.

- Fig. 1. Right radius of *Leptophoca lenis*? Exterior view. Cat. No. 5362.  
 2. Proximal end of conjoined tibia and fibula of *Leptophoca lenis*? Anterior view. Cat. No. 5361.  
 3. Posterior lumbar vertebra of *Leptophoca lenis*? Dorsal view. Cat. No. 5363.  
 4. Humerus of a fossil sirenian from the same locality as *Leptophoca*. Anterior view. Cat. No. 5360.  
 (All the figures natural size.)

<sup>a</sup>G. B. Shattuck, Geological and paleontological relations, with a review of earlier investigations, Rept. Maryland Geol. Surv., Miocene, Text, 1904, pp. lxxxvi to xcii.

<sup>b</sup>P. J. Van Beneden—Description des Ossements Fossiles des environs d'Anvers, 1re Partie, Pinnipèdes, Ann. Mus. Roy. d'Hist. Nat. Belg., I, 1877, p. 79.



HUMERUS OF LEPTOPHOCA LENIS AND OF PHOCA GREENLANDICA.

FOR EXPLANATION OF PLATE SEE PAGE 840.





BONES OF *LEPTOPHOCA LENIS* AND OF A FOSSIL SIRENIAN.

FOR EXPLANATION OF PLATE SEE PAGE 840.



## THE GIANT BASS OF JAPAN.

By DAVID STARR JORDAN and JOHN OTTERBEIN SNYDER,  
*Of Stanford University, California.*

On the coasts of Japan are found two species of bass-like fishes, each reaching a huge size and comparable to the immense fishes known as jew-fishes on the coast of the United States. These species are the Ishinagi (stone-bass) or O'uwō (giant fish), *Stereolepis ischinagi*, (= *Megaperca ischinagi* Hilgendorf), and the Aburabodzu (fat-priest) (*Erilepis zonifer* Lockington = *Ebisus sagamius* Jordan and Snyder). The first species belongs to the family Serranidæ, the other to the family Anoplopomatidæ, the two being not at all related. The accompanying plates are by Mr. William S. Atkinson.

### 1. STEREOLYPIS ISCHINAGI (Hilgendorf).

*Megaperca ischinagi* HILGENDORF, Sitz, Naturf. Freunde, Berlin, 1878, p. 156 (Tokyo).—STEINDACHNER and DODERLEIN, Fische Japans, I, 1883, p. 228, pl. III, fig. 3 (Tokyo).—JORDAN and SNYDER, Check-List Fishes Japan, 1900, p. 73 (Yokohama).—JORDAN and SNYDER, Proc. U. S. Nat. Mus., XXIII, 1900 (July 2, 1901), p. 354 (Tokyo).

Head,  $2\frac{1}{6}$  in length to base of caudal; depth,  $2\frac{1}{4}$ ; depth of caudal peduncle,  $8\frac{1}{2}$ ; snout,  $3\frac{1}{2}$  in head; maxillary,  $2\frac{1}{4}$ ; eye, 5; width of inter-orbital space, 4; D. XII, 11; A. III, 7; scales, 14–87–31.

Interorbital space flat; lower jaw projecting; preorbital and suborbital with strong ridges, the suborbital ridges uniting to form a single crest, which extends upward behind the eye; lips thick; maxillary extending to a point below posterior edge of orbit, its upper edge covered anteriorly by the preorbital; supplemental maxillary distinct, its lower edge with a pronounced ridge. Teeth in broad villiform bands on jaws, vomer, palatines, and upper and lower pharyngeals: tongue smooth. Large pseudobranchiæ present; gillrakers, 3+8, large and strong. Opercle with 2 spines, the upper short and broad, the lower longer and more pointed; preopercle strongly serrate; subopercle with a few serrations; edge of interopercle rough; throat, snout and top of head naked; occipital and parietals with a few strong radiating ridges, which show through the naked skin; cheeks and opercles scaly; scales

of head and body cycloid, growing slightly ctenoid posteriorly; each scale with a vertical, tuberculate ridge, imparting a characteristic roughness to the covering of the body; fins with minute scales; lateral line following the contour of back; first dorsal spine very short, almost entirely concealed; the fifth ray longest,  $1\frac{1}{2}$  in head; membrane of spinous dorsal deeply incised between spines, the attached portion of the membrane extending halfway up anterior edge of spine; longest dorsal ray,  $2\frac{1}{2}$  in head; edge of fin, rounded; origin of anal below base of third dorsal ray; the spines strong and prominent, the second,  $4\frac{1}{2}$  in head; margin of fin rather pointed in outline; pectoral unsymmetrical, upper rays longest,  $2\frac{1}{2}$  in head; ventral,  $1\frac{1}{2}$ ; caudal,  $6\frac{1}{2}$ , lunate.

Body olivaceous, with 6 broad lateral dusky stripes; the first extending along base of dorsal, the second following lateral line to caudal peduncle where it joins the third, the fourth passing from

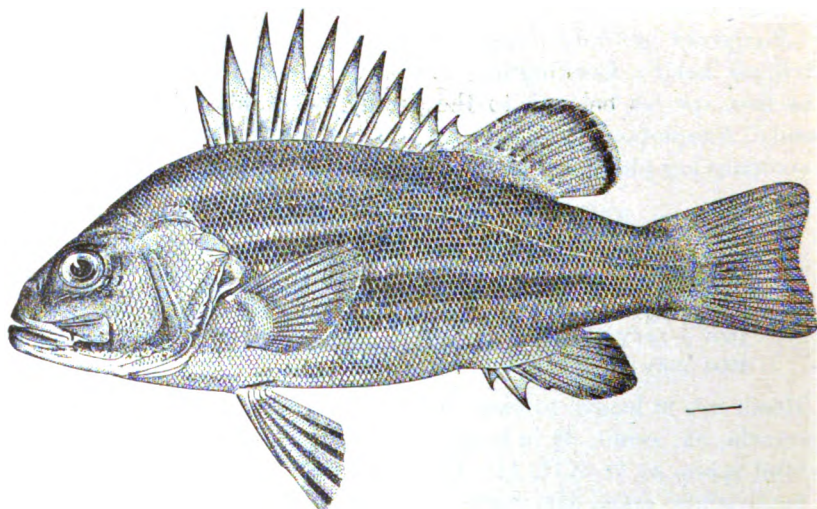


FIG. 1.—STEREOLYPIS ISCHINAGI.

base of pectoral to caudal, the fifth and sixth rather indistinct, merging near base of anal; head dusky above; soft dorsal, anal and pectorals strongly edged with dusky, the soft dorsal narrowly tipped with whitish.

Described from a specimen 14 inches long taken at Hakodate by the U. S. Fish Commission Steamer *Albatross*.

In our explorations of Japan we saw specimens of the *Ishinagi* at Hakodate, Tokyo, Yokohama, and Misaki. The largest of these was about 6 feet in length. The species is apparently more common in northern Japan than southward, the center of abundance being about Hakodate and the Straits of Tsugaru.

This species is well separated from *Stereolepis gigas* Ayres, of the coast of California, by the larger scales, and especially by the form of

its spinous dorsal fin, the spines in *Stereolepis gigas* being very much lower. The nominal genus *Megaperca*, however, differs but slightly from *Stereolepis*, the only tangible character resting in the marked elevation of the dorsal spines, the first dorsal being low in *Stereolepis*. The scales in *Stereolepis* are a shade thicker and rougher, but the difference is not one of importance.

## 2. ERILEPIS ZONIFER (Lockington).

### ABURABODZU.

*Myrioilepis zonifer* LOCKINGTON, Proc. U. S. Nat. Mus., 1880, p. 248 (Monterey, California).—JORDAN and GILBERT, Synopsis, Fish, North America, 1883, p. 649 (same specimen).

*Erilepis zonifer* GILL, Science, Jan. 6, 1894, p. 54 (generic name a substitute for *Myrioilepis* preoccupied by *Myrioilepis* Egerton, a genus of fossil fishes).—JORDAN and EVERMANN, Fish, North and Mid. Amer., II, 1898, p. 1863, Monterey Bay.—SMITH, MS., 1905 (specimen from Kochi, Japan).

*Ebirus sagamius* JORDAN and SNYDER, Journ. College Science, Imperial Univ. Tokyo, XV, 1901, p. 308, pl. xv, figs. 3, 4, (Misaki, on Sagami Bay, Japan).

*Erilepis zonifer* was first known from a specimen a foot long, taken in Monterey Bay in 1879 by Mr. William Neale Lockington, this

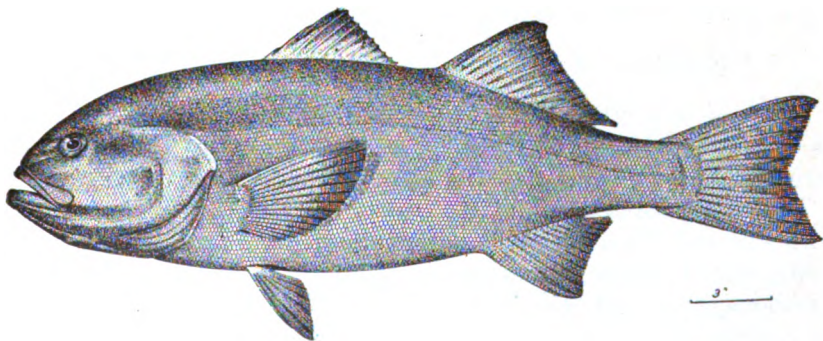


FIG. 2.—ERILEPIS ZONIFER.

specimen being placed in the California Academy of Sciences. No more specimens of this genus were known until the present writers found in the Imperial Museum at Tokyo a very large example, eviscerated and stuffed. In this specimen the union of the gill-membranes to the isthmus did not appear, and the existence of the suborbital stay beneath the skin of the cheek was not suspected. The fish was taken as the representative of a very aberrant new genus of *Serranidae*, and it was described under the name *Ebirus sagamius*.

For the information as to the identity of *Ebirus* with *Erilepis* we are indebted to Dr. Hugh M. Smith, who found a very young example, about 4 inches long, at Kochi, in the island of Shikoku, in Japan. This specimen was identified by Doctors Gill and Smith as the young of *Erilepis zonifer*, and on this suggestion we have reexamined our speci-

men of *Ebisus sagamius*. We find it to be an *Erilepis*, and we can not separate it from *Erilepis zonifer*.

We have now before us a large example in alcohol of the Aburabodzu, sent to us, together with measurements and photographs, by Mr. T. Matano, president-general of the Imperial Museum of Japan. From this specimen we are enabled to give a more exact description of the species, and to correct some errors in the account of *Ebisus sagamius*. Our specimen having been eviscerated, the characters of the tongue, gill-arches, and pyloric cæca can not be given. The anal fin is apparently without spines, but three very small ones appear on dissection in the thick oily skin. The top of the head is covered with fine, embedded scales. Our specimen differs from the account of the Californian specimen called *Erilepis zonifer* in the color, which no doubt changes with age, and in the number of dorsal spines. In our specimen the two dorsal fins are separated, and the fin-rays are D. XII-16. In Lockington's example we counted D. XIV-I, 15. This difference in the number of spines may be fallacious, as one or two may be concealed in the thick skin of our adult specimen.

In any event it is certain that *Ebisus* is a synonym of *Erilepis*. The Japanese species is probably the original *Erilepis zonifer*. If it should prove distinct it would stand as *Erilepis sagamius*.

#### DESCRIPTION OF ERILEPIS ZONIFER FROM TOKYO.

Head,  $3\frac{1}{2}$  in length; depth,  $3\frac{1}{4}$ ; depth of caudal peduncle,  $11\frac{1}{2}$ ; eye,  $6\frac{3}{4}$  in head; snout, 3; width of interorbital space,  $2\frac{1}{4}$ ; length maxillary,  $2\frac{1}{4}$ ; D. XII-16; A. III-12; scales in lateral series, 122.

The body is notably short and stout, the skin thick and saturated with oil, this imparting a characteristic plumpness which has suggested the Japanese names Aburabodzu, meaning "fat priest," and Aburainagi, or "fat bass." The head is large; anterior profile convex; interorbital space broad and moderately convex; snout short; lower jaw projecting slightly; maxillary without supplemental bone, extending posteriorly to a point below middle of orbit; width of narrowest part of preorbital equal to vertical diameter of eye; nostrils, two on each side; anterior nostril circular, with an elevated rim, the posterior part of which rises in an angular prominence; posterior nostril oblong; branchiostegals 7, their membranes scaly; teeth small, curved, in broad bands on jaws and on anterior ends of palatines and vomer; cheek with a long strong suborbital stay hidden under the thick skin; pseudobranchiæ present; gill-membranes rather narrowly united to the isthmus; head without spines or serrations, completely scaled except on lips; scales small, ctenoid, well embedded; those on upper anterior part of head, snout, and chin minute; rays and spines of fins generally with scales; posterior dorsal spines smooth; interradi al membranes scaly, especially on the caudal; lateral line complete to

base of caudal fin, following in curvature the dorsal contour of body; origin of spinous dorsal a little anterior to that of ventral; first dorsal spine short, almost concealed; third spine longest,  $2\frac{1}{4}$  in head; space between spinous and soft dorsal about equal to vertical diameter of eye; height of longest (third or fourth) dorsal ray,  $2\frac{1}{2}$  in head; origin of anal below fifth dorsal ray; spines of anal inconspicuous, partly concealed in fatty tissue and closely apposed to the first ray; the anterior one minute and easily overlooked; longest (first) ray  $2\frac{1}{4}$  in head; upper rays of pectoral longest,  $1\frac{1}{2}$  in head; ventral,  $2\frac{1}{4}$ ; posterior edge of caudal lunate,  $1\frac{3}{8}$  in head. Color in spirits, plain brown, the fins edged or tipped with dusky. Length, 35 inches. Tokyo, Japan.

The specimen probably came from the fisheries of Misaki. Although so rare in collections the species is well known to the fishermen. According to Kuma Aoki, master fisherman at Misaki, the species reaches a weight of 200 pounds. The type of *Ebisus sagamius* was 57 inches long (1.40 meters).



## A NEW SPECIES OF CŒNOCYATHUS FROM CALIFORNIA AND THE BRAZILIAN ASTRANGID CORALS.

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By T. WAYLAND VAUGHAN,

*Custodian of Madreporarian Corals, U. S. National Museum; Geologist, U. S. Geological Survey.*

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### I. A NEW SPECIES OF CŒNOCYATHUS FROM CALIFORNIA.

**CŒNOCYATHUS BOWERSI**, new species.

Plate LXXVII, figs. 1-3.

Corallum forming a clump of rather low corallites, reproduction by lateral gemmation. The free portions of the corallites are cylindrical or gradually enlarged upward, varying from 3.5 to 7.5 mm. in height. Transverse outline of the calices subcircular or slightly compressed, diameter from 4.5 to nearly 7 mm. Externally costate; the costæ equal, low, flat, and granulate, separated by narrow, slightly impressed intercostal furrows.

In the larger calices the fourth cycle of septa almost complete, primaries and secondaries of practically the same thickness and length, moderately stout, tertiaries and quaternaries usually rather thin. Septal margins entire, very slightly exsert. Septal faces densely and coarsely granulate. Pali strongly developed before the penultimate cycle, resembling those of *Caryophyllia*; they are usually much thicker than the septa before which they stand, and are about half as long.

Calice excavated, rather deep, abruptly depressed in the center. Columella well developed, composed of one or a few twisted or curled laths.

*Locality*.—San Miguel Island, California.

*Type*.—Cat. No. 21,138, U.S.N.M., donated by Dr. Stephen Bowers, of Los Angeles, California.

## II. THE BRAZILIAN ASTRANGID CORALS.

In my *Stony Corals of the Porto Rican Waters*<sup>a</sup> I published the following paragraph: "There are three astrangids found on the Brazilian reefs. One is *Phyllangia americana*; another may be only a varietal form of *A. solitaria*, but probably is a distinct species; the third is an undescribed species, which I have named in manuscript, *Astrangia rathbuni*." Professor Verrill cites these remarks in his *Revised List of Brazilian Reef Corals*.<sup>b</sup> It is scarcely necessary to make remarks on the *Phyllangia americana*, but the two others will be described.

**ASTRANGIA BRASILIENSIS, new species.**

Plate LXXVII, figs. 3—6.

Corallites reproducing by budding from basal stolons, spreading over variously shaped objects of support, occasional lateral gemmation. The corallites are scattered, distant, from 1.5 to 4 mm., or even more, between their bases. Diameter at the calice from 2 to 4 mm.; height of full-grown corallites about 4 mm. Externally obscurely costate near the calicular edge, the costæ alternating in size. The lower portion of the corallites is encrusted, in some instances there appears to be epitheca.

Septa in three complete cycles with about half the members of the fourth, in a calice 2.5 mm. in diameter. This seems to be the usual number in the larger calices. The primaries may be slightly the largest, the secondaries almost equal them in size, or primaries and secondaries may be of practically the same size; the tertiaries are smaller; the quaternaries often rudimentary. Septal margins obscurely dentate, only slightly exsert. Erect narrow paliform lobes present before all septa except those of the last cycle. Sides of both septa and pali granulated. Calicular fossa deep. Columellar surface papillate.

*Locality*.—Periperi, Bahia, Brazil.

*Type*.—Cat. No. 10940 U.S.N.M. Collected by Richard Rathbun, Geological Commission of Brazil, 1876.

*Remarks*.—The preceding description is based on a single specimen. There are several other specimens in the United States National Museum. The principal variation shown is in the height of the corallites, which may be between 9 and 10 mm. tall. When the corallites are so tall the calices are somewhat larger, nearly 5 mm. in diameter, the septa somewhat more exsert and the costæ more pronounced.

*A. brasiliensis* is very closely related to *A. solitaria* (Le Sueur). The corallites of the former average smaller, are more scattered and

<sup>a</sup> U. S. Fish Commission Bulletin for 1900, II, 1901, p. 299.

<sup>b</sup> Trans. Conn. Acad. Sci., XI, 1902, p. 194.

more isolated than in the latter; the septa of the latter are stouter. *A. rathbuni* (the second Brazilian *Astrangia*) resembles *A. solitaria* in habitus more than does *A. brasiliensis*.

**ASTRANGIA RATHBUNI, new species.**

Plate LXXVIII.

Corallum incrusting, attached to objects of various shapes, often forming small, rounded clumps. The corallites are not crowded, and are more or less tufted. Reproduction by basal expansions, which are frequently stoloniferous in character, occasionally by lateral gemmation. Sometimes there appear to be shreds of epitheca around the corallites.

The corallites are rather tall, as much as 7 mm., but 4 mm. is probably an average. The calices are rather large. The measurements of 3 are as follows:

| Measurements.         | 1.  | 2.  | 3.  |
|-----------------------|-----|-----|-----|
|                       | mm. | mm. | mm. |
| Greater diameter..... | 7   | 6   | 4.5 |
| Lesser diameter.....  | 6   | 5   | 3.5 |

The costæ of the corallites are indistinct, except just below the calicular margin, where they are small, but show a recognizable alternation of larger and smaller.

The septal margins project very slightly above the upper edge of the corallite wall; the septa are thin and narrow above the bottom of the calicular fossa. In the larger corallites there are four complete cycles. The members of the first and second cycles reach the columella, those of the third cycle usually bend toward the members of the second, and those of the fourth toward the members of the third. The margin of all septa are dentate, the dentations frequently truncated, sometimes showing secondary dentations on the inner edge, but not in the sinus between dentations. Paliform lobes are not distinctly differentiated. The calicular fossa is very deep. The columella is weak and is papillary above.

*Localities*.—Paqueta, Rio Janeiro, and Bay of Rio Janeiro, Brazil.

*Type specimen*.—Paqueta, Rio Janeiro (No. 10974, U. S. Nat. Mus.). Collected by Richard Rathbun, Geological Commission of Brazil, 1877. There are eight specimens in all.

*Remarks*.—The most nearly related recent species of the West Indian region is *Astrangia astreiformis* M. Edwards and Haime. The corallites of this species are more intimately united one to another,

the septa are thicker, in three cycles, and the calicular fossa is shallower. *A. rathbuni* is more closely related to *Astrangia lineata* (Conrad) from the Chesapeake Miocene of the eastern United States, but there are important differences. The corallites of *A. lineata* are decidedly larger and are more turbinate in shape.

This species is named for Dr. Richard Rathbun.

#### EXPLANATION OF THE PLATES.

##### PLATE LXXVII.

Figs. 1, 2, 3, *Ctenocyathus bowersi*, new species. Fig. 1, a side view of the corallum, natural size; fig. 2, side view of a corallite, x 4; fig. 3, calicular view of a corallite, x 4.

Figs. 4, 5, 6, *Astrangia brasiliensis*, new species. Fig. 4, view of a colony from above, natural size; fig. 5, calicular view of two corallites, x 4; fig. 6, view of the side of the same corallites, x 4.

##### PLATE LXXVIII.

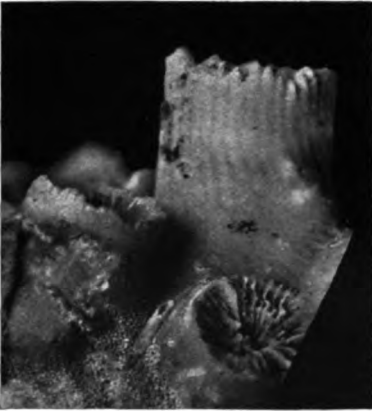
*Astrangia rathbuni*, new species. Fig. 1, corallum, natural size; fig. 2, calices, x 4; fig. 3, costæ, x 4.



1



6



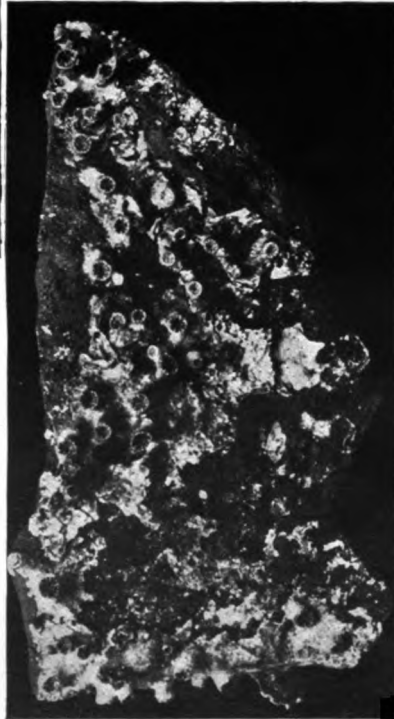
2



5



3



4

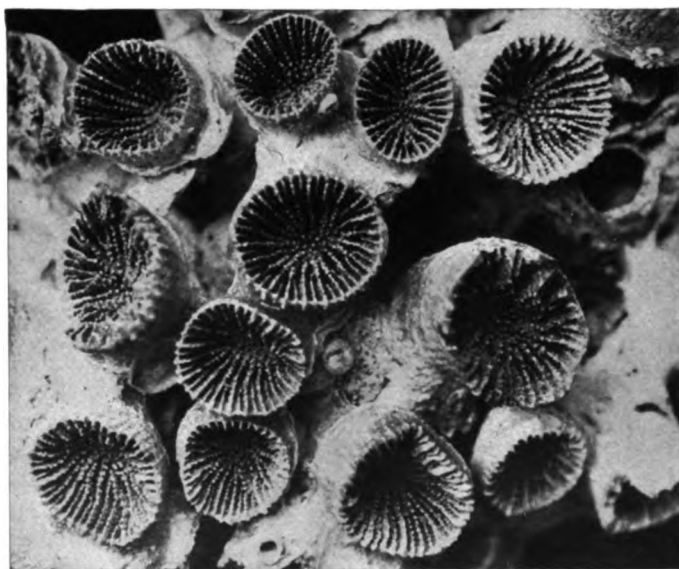
**CÆNOCYATHUS BOWERSI AND ASTRANGIA BRASILIENSIS.**

FOR EXPLANATION OF PLATE SEE PAGE 850.

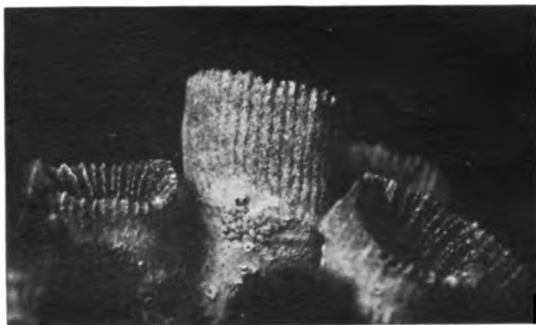




1



2



3

**ASTRANGIA RATHBUNI.**

FOR EXPLANATION OF PLATE SEE PAGE 850.



## NEW FISHES FROM SANTO DOMINGO.

By BARTON W. EVERMANN and H. WALTON CLARK.

*Of the U. S. Bureau of Fisheries.*

Recently Mr. August Busck, of the Bureau of Entomology, U. S. Department of Agriculture, spent several months in the West Indies in the interests of that Bureau. While in the interior of Santo Domingo, some 40 miles northwest from the capital, he collected a few small fishes from a small brook in the San Francisco Mountains. These have been turned over to us by Mr. Busck for identification.

Although the collection is very small, containing but 6 specimens, it proves to be of much interest in that 3 of the 4 species represented appear to be entirely new.

All the specimens are in fair condition. The following is a list of the species represented, with descriptions of those believed to be new:

**PLATYPECILUS PERUGIÆ** Evermann and Clark, new species.

Head  $\frac{1}{2}$  in body; depth 3.4; eye 3 in head; snout 3.4; interorbital 2; D. 8; A. 7; Br. 6; scales 28-8, 12 in front of dorsal.

Body short, greatly compressed, especially posteriorly, the dorsal contour gently arched from nape to origin of dorsal fin; the ventral outline strongly arched from tip of snout to origin of anal, the sides of the long, greatly compressed caudal peduncle nearly straight; least depth of caudal peduncle 1.5 in head, and 2 in its length from posterior end of base of dorsal; head rather small, broad and flat above, rather sharp and wedge-shaped in lateral profile; mouth a very small straight transverse slit at tip of snout, somewhat above level of middle of orbit; premaxillaries very protractile; when drawn out the mouth assumes the form of a short, round tube; lips thin, the lower somewhat cleft; teeth minute, conical, clear in color, apparently in one row along the edge of the lower jaw, in the movable bones of which they are loosely set.

Dorsal rather short but high, its longest ray 1.75 in head, its base 2, its origin midway between tip of snout and middle of caudal fin; anal similar, set somewhat farther back, its origin about under the middle

of dorsal; ventrals rather short, reaching to vent; pectoral reaching about to origin of ventrals; caudal broad, rounded; scales large.

Color in spirits, yellowish brown; a very narrow but faint black dorsal streak; upper parts of side with minute punctulations which tend to collect along the edges of the scales, giving the appearance of light spots alternating with dark crescents along the rows of scales; the spots tend to collect more densely, and in the center of the row of scales along axis of body, making a narrow black line along the middle of the side and another short line beneath it for the anterior third of the length; scales on base of caudal with one minute row of dots along the margin, giving, under magnification, the appearance of a delicate lace-work; cheek silvery; fins pale, except the dorsal which is some-

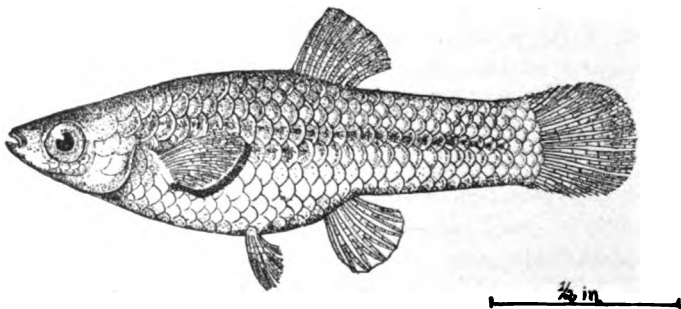


FIG. 1.—*PLATYPÉCILUS PERUGIE*.

what dusky and with a small black blotch at the posterior edge of its base; peritoneum black.

One specimen, a female containing a number of rather large yellow eggs; differing from related species by its much narrower compressed body, larger eye, more fully arched back and general coloration, and in having teeth larger and more evident.

This species is close to *P. mentalis*, described in 1876 by Doctor Gill, from the Isthmus of Panama. A comparison of our specimen with the type of that species shows it to differ in several important respects, namely, the smaller dorsal and anal, somewhat smaller scales, shorter snout, and in the coloration.

*Type*.—Cat. No. 53278, U.S.N.M., a female 1.63 inches long, collected in September, 1905, in a small stream in the San Francisco Mountains, Santo Domingo, by August Busek.

We take pleasure in naming this species for Dr. Alberto Perugia in recognition of his work on the fishes of the West Indies.

***PLATYPÉCILUS DOMINICENSIS* Evermann and Clark, new species.**

Head 3.9 in body; depth 3.75; eye 3.2 in head; snout 3.5; interorbital 1.75; D. 8; A. 8; V. 6; P. 13; scales 27–8, 12 in front of dorsal.

Body robust, not greatly compressed except posteriorly; caudal peduncle very deep, its least depth about 1.5 in head; head and body

to dorsal flattened above; head small, upper outline straight, lower curved; mouth a small horizontal cleft, in line with axis of eye; premaxillaries very protractile; teeth on edge of jaw very small, conical, brown-tipped, apparently in one row, and loosely set in the weak lower jaw.

Dorsal short, rather low, its longest ray about 2.3 in head, its base 2.5, its origin about midway between tip of snout and end of caudal fin or midway between gill-slit and base of caudal; anal similar to dorsal, its origin under third dorsal ray; ventrals about 1.6 in head, their tips reaching vent; length of pectoral about 1.5 in head, the tip scarcely reaching origin of ventrals.

Color in alcohol, yellowish, with a rather broad distinct black line along middle of back, and a black blotch at posterior part of base of dorsal fin; side dusky above, the color due to fine punctulations distributed mostly at the bases of the scales, the posterior margin of each scale yellowish; belly, lower half of side, and under parts of head

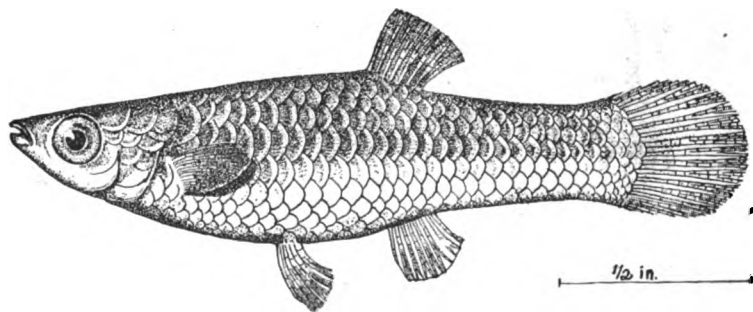


FIG. 2.—*PLATYPOCILUS DOMINICENSIS*.

yellowish; pectoral and dorsal dusky, other fins plain; tip of lower jaw dusky, gill-covers dusky, gill-cavity dark; peritoneum black.

The collection contains 3 specimens, all females, about 1.5 to 2 inches in length.

This species is closely related to *Platypocilus perugiae*, from which it differs, however, in the thicker body, the less arched back, the smaller eye, in the presence of a very distinct black line along median line of back, and in the darker coloration of the back and upper part of side; the interorbital space is also wider and the caudal peduncle deeper.

The type specimen contained 12 eggs, yellow in color, and about one-ninth inch in diameter.

*Type*.—Cat. No. 53277, U.S.N.M., a female 2 inches long, collected in a small stream in the San Francisco Mountains in the interior of Santo Domingo, some 40 miles from Santo Domingo City, September, 1905, by August Busck; cotypes, No. 1434, Bureau of Fisheries, and No. 9350, Stanford University, from same locality.

**AGONOSTOMUS MONTICOLA (Bancroft).**

DAJAO.

One specimen 3 inches long.

**SICYDIUM BUSCKI** Evermann and Clark, new species.

Head 4.25 in body; depth 6; eye 4.75 in head; snout 2.37; maxillary 2; interorbital 3; scales 57-20; D. VI-I, 8; A. I, 7; P. 18.

Body elongate, rather quadrate in cross-section, the back broad and flat or slightly concave, the caudal peduncle stout, its least depth 1.97 in length of head; head rather large, broad and flattish above, the frontal profile rounded, the eyes near the top of the head and projecting above the profile; mouth horizontal, small, the mandible not reaching to anterior border of orbit, the blunt snout and upper jaw much projecting beyond the small lower jaw; teeth minute, those in upper jaw brown, curved, the posterior side concave, the anterior convex, in a single rasp-like row hidden behind the thin but somewhat

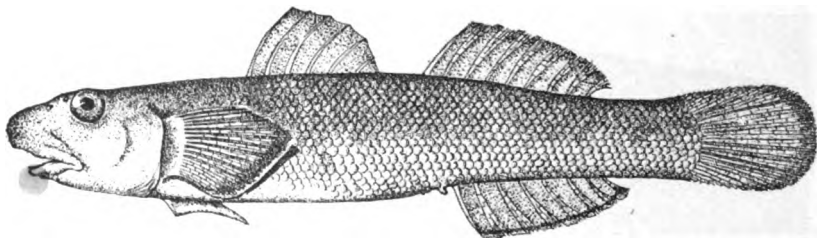


FIG. 3.—*SICYDIUM BUSCKI*.

fleshy upper lip, those in lower jaw small but stout and conical, brown-tipped, few in a single row which is interrupted in the middle and terminated at each end by peculiar and conspicuous tubercles which arise on a sharp ridge situated on or just within the fleshy lower lip; a thin fold with a central projection just back of the teeth, corresponding to the broader palatine fold above; gill-slits rather narrow, gill-membranes broadly joined to the isthmus.

Spinous dorsal rather low, its longest spine 2.16 in head, its base 1.32, its origin about one-third the distance from tip of snout to base of caudal, its contour gently rounded, the posterior rays lying close to back; soft dorsal similar in shape but more produced behind, its longest ray 2.71 in head, its base longer than head, about 4.25 in body, its origin midway between eye and base of caudal; anal similar in shape to soft dorsal and inserted somewhat behind it, its longest ray 2.71 in head, its base 1.13 in head; pectoral broad and rounded, extending back to about middle of spinous dorsal, its length 1.39 in head; ventrals united into a round disk, rather straight in front, but rounded behind, displaying in the bottom 6 stout radiating ridges (3 on each

side), these arising from a common center and pointing outward and backward and branching at the end into smaller rounded ridges, between which are intercalated other fine round ridges, somewhat resembling the gills of a mushroom in general disposition, and terminating in the finely crenulate margin of the disk; caudal broadly rounded, scales small, weakly ctenoid; head, cheeks, and breast naked.

General color in alcohol, yellowish brown, somewhat mottled with olivaceous above, the sides with minute punctulations which are more crowded in the centers of the scales along the side forming indistinct horizontal dark lines along the rows of scales; belly white; fins somewhat dusky, the dorsals dark-edged, anal with a black line near the margin, caudal blackish at the tip; in some lights there appears to be a series of faintly dusky blotches along the sides and along the back; peritoneum apparently blackish.

This fish appears to be closely related to *S. punctatum* Perugia, which it resembles in general coloration and in the number of scales. It differs from that species, however, in having a much longer snout, shorter pectoral, smaller eye, and in having fewer rays in the dorsal and anal fins, and the lower part of the head is not evidently punctate.

Only one specimen obtained, the type, No. 53276, U.S.N.M., 2.375 inches long, small brook in San Francisco Mountains, Santo Domingo, collected September, 1905, by August Busck, for whom we take great pleasure in naming the species.



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